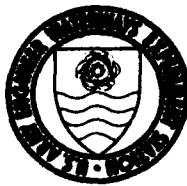
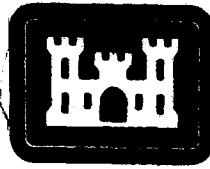


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GEOMORPHIC INVESTIGATION OF THE BAYOU BODCAU AND TRIBUTARIES PROJECT AREA, LOUISIANA

by

Lawson M. Smith

Geotechnical Laboratory
U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180

September 1982

Final Report

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Prepared for U. S. Army Engineer District, Little Rock
Little Rock, Ark. 72203

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20. ABSTRACT (Continued).

geomorphic features in the study area, (b) development of a chronology for the geomorphic features, and (c) estimation of the probability of the existence of buried geomorphic features of archaeological significance.

Geomorphic features of the study area were defined on the basis of interpretation of aerial photographs, topographic maps, soil maps, borings, and field observations. These geomorphic features, delineated on four 7-minute (1:24,000) USGS topographic quadrangles, include abandoned channels, abandoned courses, raft distributary channels, overflow channels, natural levees, crevasses, point bars, backswamps, rimswamps, valley margin lakes, upland scarps, and historic accretion deposits. Considering the dominantly aggradational nature of the Red River floodplain over the last 18,000 years and the existence of three distinct meander belts on the modern floodplain, a general chronology for the three meander belts is given, based on extrapolation of the chronology developed by Russ (1975) for the Red River meander belts immediately to the south of the study area. Long-term aggradation in the Red River Valley has undoubtedly buried sites of prehistoric cultural occupation, with older cultural horizons probably occurring at substantial depths below the present floodplain surface.

Based on the consideration of the apparent geomorphic development of the study area and several basic assumptions of environmental preference of prehistoric cultures, recommendations for the cultural resources survey of the impacted area are made.

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PREFACE

The investigation summarized in this report was performed by personnel of the U. S. Army Engineer Waterways Experiment Station (WES) and was authorized by the U. S. Army Engineer District, Little Rock on DA Form 2544, No. LMNED-82-52, "Geomorphic Investigation of the Bayou Bodcau and Tributaries Project Area," dated 14 April 1982.

The investigation was performed during the period 12 April to 31 May 1982 under the direct supervision of Mr. John H. Shamburger, Chief, Engineering Geology Applications Group (EGAG), Engineering Geology and Rock Mechanics Division (EGRMD), and under the general supervision of Dr. Don C. Banks, Chief, EGRMD, and Dr. William F. Marcuson III, Chief, Geotechnical Laboratory (GL). The investigation was performed and the report prepared by Mr. Lawson M. Smith, EGAG. Ms. Lisa Beard, Physical Science Aid, EGAG, assisted in the compilation of data.

The Commander and Director of WES during the period of this study was COL Tilford C. Creel, CE. Technical Director was Mr. Fred R. Brown.



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CONVERSION FACTORS, U. S. CUSTOMARY TO METRIC (SI)
UNITS OF MEASUREMENT

U. S. customary units of measurement used in this report may be converted to metric (SI) units as follows:

<u>Multiply</u>	<u>By</u>	<u>To Obtain</u>
cubic feet	0.02831685	cubic metres
feet	0.3048	metres
miles (U. S. statute)	1.609347	kilometres
square miles	2.589998	square kilometres

GEOMORPHIC INVESTIGATION OF THE BAYOU BODCAU
AND TRIBUTARIES PROJECT AREA, LOUISIANA

PART I: INTRODUCTION

Background

1. In an effort to reduce damage caused by frequent flooding in the Red River floodplain in the vicinity of Shreveport, La., the construction of levees and improvement of drainage channels is planned in the affected area. Prior to construction, a cultural resources survey of the project area will be performed in an effort to minimize the loss of potential archaeological information during and after construction activities. A geomorphic analysis of the project area was requested to serve as a guide for estimating the potential location of cultural resources (archaeological sites) and as a means for describing the environmental context of those sites which may be located during the cultural resources survey.

Objectives

2. The objectives of this investigation are twofold: (a) to describe the geomorphic development of the project area, and (b) to determine the significance of the geomorphic development of the area to aid in the location of archaeological sites.

Scope

3. Bayou Bodcau and Tributaries Project Area covers a linear distance of approximately 21 miles* from Sligo, La., to about 3 miles south of Ninock (Figure 1). Presently, construction has already begun or has been completed in the project area north of Curtis-Sligo Road. This

* A table of factors for converting U. S. customary units of measurement to metric (SI) units is presented on page 3.

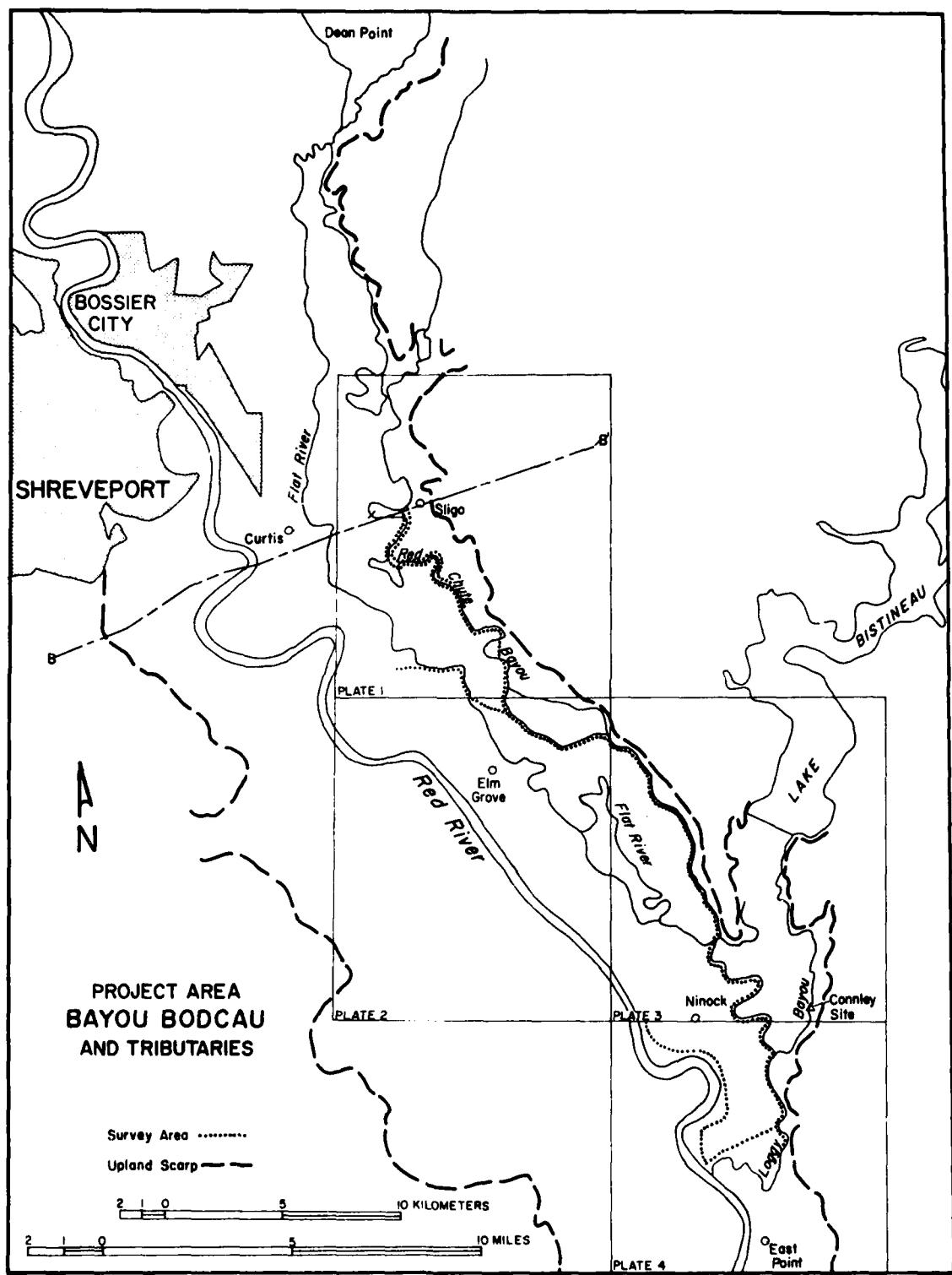


Figure 1. Bayou Bodeau and Tributaries Project Area

report is directed to the project area south of Curtis-Sligo Road in the vicinity of Red Chute Bayou and Flat River (covered on the Sligo, Elm Grove, Bossier Point, and East Point 1:24,000 topographic quadrangles). While most of the geomorphic features discussed in this report apply specifically to the project area in the vicinity of Red Chute Bayou and Flat River south of Curtis-Sligo Road, the features also occur in the rest of the project area. Consequently, much of the information contained in this report may be readily extrapolated to include the entire project area of the Red River floodplain from the vicinity of Dean Point to East Point, La.

PART II: GEOMORPHIC DEVELOPMENT OF THE AREA

Introduction

4. The Red River floodplain is a product of a complex assemblage of processes that have been operating at various magnitudes and frequencies over thousands of years. The diversity of environments of the floodplain and adjacent uplands indicates the complex geomorphic history which profoundly influences the cultural prehistory of the area. In order to place the modern floodplain into an appropriate archaeological context and to begin to understand the archaeological significance of the subsurface, it is necessary to reconstruct, to the extent possible, the geomorphic development of the Red River floodplain in the study area.

Previous Studies

5. The diversity of geologic phenomena of the Red River Valley has attracted geologic research and exploration in the region for over 80 years. Reports of early explorations by Dunbar (1804), Darby (1816), Stoddard (1812), and Sibley (1806) contain vivid descriptions of the region that suggest a multiplicity of avenues of research into geologic processes and materials. Veatch (1899, 1902, 1906) produced a series of seminal reports on the geologic history of the region and the Shreveport area. Most of Fisk's discussion of the Red River Valley in his treatise on the alluvial valley of the Lower Mississippi River concerned the Red River Valley south of Alexandria; however, his alluvial chronology of the Lower Mississippi River formed the foundation for interpreting the geomorphic development of the Red River Valley (Fisk, 1944). Extrapolations of Fisk's ideas are evident in Murray's Geology of DeSoto and Red River Parishes (Murray, 1948), which contains a description of former courses of the Red River and Pleistocene terraces in the southernmost portion of the study area.

6. Fisk's foundations of alluvial chronology also are apparent in Kolb's study (1949) of the Entrenched Valley of the Lower Red River, a detailed discussion of the nature of the base of the Red River floodplain (top of Tertiary) from Red River Parish to the Mississippi River. A second geologic report on the Lower Red River Valley was published at the U. S. Army Engineer Waterways Experiment Station (WES) by Schultz and Krinitzsky in 1950, presenting an expansion of the previous investigation by Kolb (1949) into the alluvial geology, geologic history, and geologic-engineering significance of the alluvial deposits.

7. A detailed description and analysis of changing meander morphology and hydraulics of the Red River over the period 1838 to 1957 is given by Abington (1973). Abington's analysis documents the mechanisms responsible for metamorphosis of the Red River during the last 140 years and presents a major difference in interpretation from that of Fisk. Saucier's revision of the Quaternary Geology of the Lower Mississippi Valley laid the foundation for an alternative interpretation (to Fisk's) of the geologic history of the region, based on detailed geologic mapping throughout the Lower Mississippi Valley conducted at WES (Saucier, 1974). As part of this geologic mapping effort, the Red River Valley south of the Arkansas state line was mapped at the scale of 1:62,500 (Smith and Russ, 1974). Russ expanded the data derived from the geologic mapping into a comprehensive and detailed statement on the geomorphic development of the Lower Red River south of the Saline River (Russ, 1975). These previously published and unpublished reports collectively comprise a valuable foundation for detailed geomorphic and archaeological investigations within the region.

Major Factors Influencing Red River Geomorphology

8. The geomorphic development of the Red River floodplain over the last several tens of thousands of years has been strongly influenced, and in some instances controlled, by at least four major factors. Of primary importance is the variation in climate through various periods of the Pleistocene and the Holocene. Changes in local base level of the

Red River through channel diversions (avulsions) also have significantly affected Red River geomorphology in the region. Geologic controls on the channel of the Red River at certain locations have undoubtedly influenced the impact of the climate and the base-level changes on the river. Evidence of the significance of the fourth factor, the Great Raft (see paragraph 16) of the Red River on geomorphic development of the floodplain, is contained in early reports on the region and may be still seen on the present landscape. A discussion of the major factors is presented in the following paragraphs.

Climatic variation

9. Variation in climate has affected the geomorphology of the Red River in at least several ways during the last several tens of thousands of years. The primary influence has been the worldwide climatic oscillations associated with waxing and waning glaciation. Reductions in sea level during waxing glaciation have occurred at least three times during the last 40,000 years. Associated with these sea-level reductions, the Red River experienced periods of entrenchment as the channel adjusted to a lowered base level. As sea level rose, valley aggradation occurred, burying former floodplain features developed during the glacial stages.

10. The result of valley entrenchment and subsequent aggradation of the Red River in the study area may be seen in Figure 2, one of the geologic sections pertaining to the Caspiana quadrangle (15 minute) contained in WES Technical Report S-74-5 (Smith and Russ, 1974). Several entrenched channels appear in the underlying Tertiary deposits, extending the normal thickness of Red River alluvium from about 70 to 110 feet. During periods of maximum entrenchment, the bed of the Red River was as much as 64 feet below the present bed of the Red River in the same area. It is quite possible that maximum channel entrenchment during the last major glacial advance, about 21,000 to 18,000 years ago, reached its greatest depth. This would mean that floodplain aggradation in the last 17,000 years may have been as much as 60 feet in some areas.

11. Climatic changes during the late Pleistocene and the Holocene have directly influenced Red River geomorphology through altering the stream and sediment discharge of the drainage basin. From its headwaters

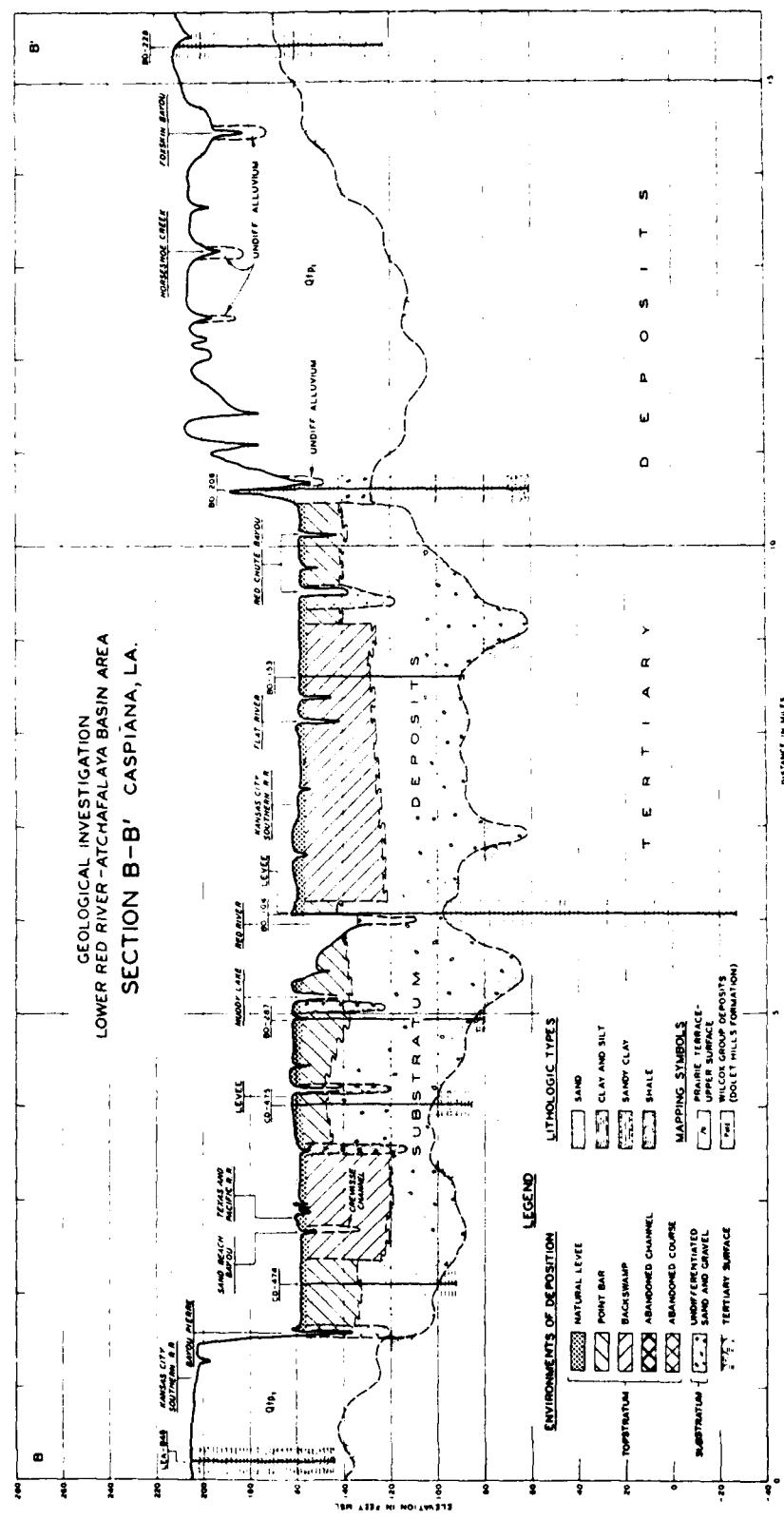


Figure 2. Section B-B', Caspiana, La.

in semiarid northeastern New Mexico to the humid-subtropical climate of Shreveport, the Red River flows through several zones which are highly sensitive to climatic variability. Changes in precipitation and temperature in the Red River drainage basin ultimately triggered geomorphic changes throughout the Red River Valley. Evidence of the changing hydraulic regime is apparent in the modern floodplain of the Red River in the vicinity of the southern end of Bodcau Lake. A relict feature of the Deweyville terrace, an abandoned channel of the Red River several times larger than the present Red River, may be seen on the floodplain surface, a vestige of a period of discharge in the Red River which greatly exceeded present discharge levels. Geomorphic response of the Red River to climatic change is probably at least partially responsible for the magnificent flights of terraces on the middle Red River between Oklahoma and Texas.

Base-level changes

12. Base-level changes occurred in the Lower Red River Valley during the Holocene which were not a direct result of sea-level fluctuations. The lower reach of the Red River to its eventual base-level control, the Gulf of Mexico, has occupied a variety of positions. Throughout much of the Holocene, the Red River has been a tributary to the Mississippi River which, in turn, flowed to the Gulf. The Red River also flowed to the Gulf through drainage of the Atchafalaya basin. Relatively rapid increases and decreases in the length of the Red River through changes in the location of the Mississippi and lower Red Rivers ultimately influenced the Red River upstream by floodplain aggradation after channel lengthening and channel degradation* as a result of channel shortening.

13. The most recent rapid change in the channel of the Lower Red River, the diversion of the old channel to a new outlet through the Moncla Gap, occurred about 600 years ago (Russ, 1975). Through its new northern route to the Mississippi, the Red River was shortened about

* Channel "degradation" is used in a strictly geological context to mean bed erosion, not degradation of the navigable quality of the channel as a waterway.

25 miles, initiating a wave of channel degradation which proceeded up the Red River.

Geologic controls on the Red River channel

14. The efficiency of the downstream channel shortening in upstream channel degradation is partially dependent upon the erodibility of the channel bed, largely a function of local geologic conditions. Degradation of the Red River channel following the Moncla Gap diversion has been partially controlled by the existence of a ledge of erosion-resistant Miocene siltstone in the channel bed near Alexandria. This resistant material inhibited the upstream migration of channel degradation, resulting in the development of a relatively steep channel just below the ledge known as the Rapides (for which the Parish is named).

15. As an aid to navigation on the river, the U. S. Army Corps of Engineers excavated more than 270,000 cubic feet of bedrock from the upper end of the Rapides in 1892-1893 (Abington, 1973). Removal of the Rapides allowed channel degradation to proceed upstream and is considered by Abington to have extended through the Shreveport area. Abington has shown that channel degradation of the Red River is the primary cause in the drastic reduction in sinuosity and increase in channel width in the study area during the last 50 years.

The Great Raft

16. A natural phenomenon of the Red River Valley which has profoundly influenced the cultural occupation and activities of the region as well as Red River geomorphology is the Great Raft. The Red River raft was actually a series of dense, impenetrable log jams located primarily on point bars of the river (Guardia, 1933). Moving progressively upstream by accretion of debris at the head and rotting of logs at the foot, the raft was estimated to be over 100 miles long in 1805. Timothy Flint described the Great Raft (Flint, 1833) as follows:

"About thirty leagues above Natchitoches commences the great raft, which is . . . a broad, swampy expansion of alluvion of the river to the width of twenty or thirty miles. The river here spreading into a vast number of channels, frequently shallow of course, has been for ages clogging with a compact mass of timber and fallen trees wafted from the upper regions. Between these masses the

river has a channel, sometimes lost in a lake, and found by following the outlet of that lake back to the parent channel. The river is blocked up by this immense mass of timber for a length on its meanders, of between sixty and seventy miles. There are places where the water can be seen in motion under the logs. In other places the whole width of the river may be crossed on horseback, and boats only make their way, in passing these places, by following the inlet of a lake and coasting it to its outlet, and thus finding the channel again. Weeds, flowering shrubs, and small willows have taken root upon the surface of this timber, and flourish above the waters. But in all these places, the course of the river, its outlines and its bends, are distinctly marked by a margin of forest trees which grow here on the banks in the same manner as they do where the channel is open."

17. The long-term process of floodplain aggradation throughout the late Pleistocene and the Holocene was accentuated in the late Holocene by the presence of the Great Raft. During periods of higher than normal discharge, the Red River was forced out of its existing channel into an anastomosing (diverging and converging) series of distributary (overflow) channels. Some of the large overflow channels occupied old abandoned courses of the Red River, accelerating the natural rate of infilling. Tributary valleys became lakes (Lakes Bodcau and Bistineau in the project area) as their main channels were blocked. The Red River floodplain became an intermittent lake over large areas, inundating all but the highest natural levees. Widespread deposition of silt and clay occurred in the Red River floodplain during the presence of the Raft, with the greatest thicknesses of raft deposits overlying the older (and topographically lower) rimswamps, backswamps, and point bars.

18. Formation of the Great Raft was probably caused by the low hydraulic gradient of the Red River above the Rapides and local bank conditions. Decreased competency of the Red River to maintain a free-flowing channel resulted from the aggradation of the Red River above the Rapides. Dense stands of timber on readily erodible streambanks provided a generous supply of debris.

19. Removal of the Great Raft was begun in 1837 to 1838 by the Corps of Engineers. It was resumed again in 1842-1843 and again in 1872. Final clearing of the raft was completed in 1873. Closing of overflow channels, clearing of channel snags, bank protection, and excavation of the Rapides has greatly reduced the probability of raft recurrence.

Development of the Modern Floodplain

20. Considering the potential impact of climatic and base-level changes, geologic control, and the Great Raft on an already highly active fluvial system, it is not difficult to imagine the development of a geomorphically complex floodplain in the Red River Valley. In mapping the geomorphic environments of the Red River floodplain in the project area, a complex geomorphic history of the region became increasingly evident. This geomorphic complexity necessitated use of all possible sources of information in development of a logical interpretation of the geomorphic evolution of the Red River floodplain in the project area.*

Methods of analysis

21. Interpretation of the geomorphic history of the project area was based on the results of four procedures with their results evaluated in consideration of previous studies pertinent to the area. Initially, a map of surficial geomorphic environments was developed at the scale of 1:24,000. The map was developed by analyzing nine series (dates) of panchromatic aerial photography varying in scale from 1:10,000 to 1:22,000, spanning the period 1939 to 1979, and a series of color infrared aerial photographs made in 1974 at the scale of 1:60,000. Topographic maps published in 1887, 1908, 1944, 1972, and 1979-1980 at various scales also were used.

22. From published U. S. Department of Agriculture (USDA) soil surveys of Bossier (1962) and Red River (1980) Parishes (USDA Soil Conservation Service and Louisiana Agricultural Experiment Station, 1962 and 1980), a soil geomorphic map** of the project area was constructed. Soil types delineated in the area were evaluated in terms of their geomorphic significance (topographic position, parent material, degree of

* Due to a lack of time, some information sources such as historic maps of the Red River were examined but not rigorously analyzed. All information sources directly pertinent to the investigation were analyzed.

** In working draft form in the WES file.

pedogenic development, texture, and soil moisture characteristics). The 56 soil types delineated were grouped into ten soil geomorphic groups (based on their similarity of geomorphic/pedogenic properties) and were mapped at the scale of 1:24,000.

23. An analysis of topographic trends in the project area was performed through the construction and analysis of a hypsometric (area-altitude) map* of the area. Elevations on the 1:24,000 topographic quadrangles were grouped into intervals of five and ten feet and portrayed by colored regions on an overlay at the scale of 1:24,000. Trends in the spatial distribution of hypsometric regions were determined through visual examination.

24. Subsurface conditions of the project area were examined by inspecting the logs of borings taken in the project area. Ninety boring logs were scrutinized, as were the results of laboratory tests performed on samples from the borings. The relationship of the subsurface materials to surface topography and geomorphic features was evaluated by plotting the borings on the 1:24,000 topographic quadrangles and constructing cross sections through the borings. Thirteen cross sections* were plotted, twelve cross-valley and one down-valley.

Geomorphic maps

25. Information derived from the soil geomorphic and hypsometric maps, the cross sections, and the boring logs was used to refine the geomorphic maps, the primary instruments employed in interpretation of the geomorphic development of the floodplain (depicted on the four 1:24,000 quadrangles, Plates 1, 2, 3, and 4). The maps portray the locations of specific geomorphic features that are the result of various geomorphic processes working on diverse geologic materials. Twelve types of geomorphic features are delineated on the geomorphic maps. They are abandoned channel, abandoned course, raft distributary channel, overflow channel, natural levee, crevasse, point bar, backswamp, rim-swamp, valley margin lake, upland, and historic accretion deposits

* In working draft form in the WES file.

26. Abandoned channel. Along actively migrating stream channels, individual meanders of the channel are often cut off during periods of high discharge. The resulting abandoned channel or "oxbow lake," as it is locally called, is stranded on the floodplain surface, often hydraulically disconnected to the active channel. The abandoned channel, now a lake, begins to fill with fine-grained sediments. The rate of filling is a function of the frequency of overbank flooding of the floodplain, the geometry and location of the abandoned channel, and the sediment load of tributary streams which enter the abandoned channel.

27. Highly arcuate channels which are cut off at the narrow neck between the two arms of the channel are called neck-cut and are usually characterized by fine-grained (silt and clay) filling and may exist for long periods (few thousand years) on the floodplain. Less arcuate crescentic channels may be abandoned when the main channel cuts across a prominent swale or chute on the upper point bar during flood. This type of cutoff is called a chute-cut abandoned channel and is usually filled fairly rapidly (few hundred years) by coarser (sand, silt, and clay) sediments from the adjacent channel during flood recession.

28. In the project area, portions of abandoned channels are readily apparent. A small highly arcuate (neck-cut) abandoned channel occurs in the SE-1/4, NE-1/4, section 14, T15N, R11W on the Bossier Point quadrangle (Plate 3). A group of nested chute-cut abandoned channels may be seen in sections 22 and 35, T15N, R11W.

29. Abandoned course. An abandoned course is similar to the abandoned channel in that the resulting lake was previously a free-flowing segment of a river. Abandoned courses include several to many meanders, however, and represent major changes in the location of the main channel, usually into a new meander belt through an adjacent backswamp. Course abandonment may occur rather rapidly, through an avulsion of the main channel, through a low spot in the channel bank, or a prominent crevasse channel. Rapid abandonment of the course leaves an environment similar to the neck-cut abandoned channel in that it is completely isolated from the active channel and may take a long time to

fill. The rapidly abandoned course often becomes the locus for a small tributary channel.

30. Abandoned courses may also be gradually deserted by the main channel. Upon bifurcation of the active channel through a newly created second channel during flood discharge, the old waterway diminishes in its relative role in containing the normal stream discharge. Eventually, a point is reached when the old channel bed has alluviated to the level that the new channel seals it off with a sand plug. Sediments of abandoned courses may be highly variable, depending upon the postdepositional history of the environment. However, their sedimentary filling usually consists of silts and clays. Several abandoned courses of the Red River occur in sections 19, 20, 29, and 30, T16N, R11W (Plate 2).

31. Raft distributary channel. Unique to the area of the historic Great Raft are raft distributary channels, major drainages which were created during high discharge as the raft-choked Red River breached its banks and divided into a series of several channels. These distributaries of the main channel probably carried from 15 to 40 percent each of the total instantaneous discharge of the Red River. They often flowed for some distance in abandoned courses of the Red River, periodically breaching them to flow across the backswamp. This phenomenon may be seen in the SE-1/4, section 32, T16N, R11W (Plate 2) where Flat River Ditch diverges from Flat River, only to flow back into Flat River about three miles downstream. Many of the raft distributary channels are open today, serving as conduits for floodplain drainage in the project area.

32. Overflow channel. The overflow channel is similar in function and origin to the raft distributary channel. These drainages are raft distributary channels in miniature. Overflow channels originated during inundation of the floodplain, and upon recession of flood levels remained as small channels that often wandered out into adjacent backswamps or abandoned channels or courses and dispersed into a swamp. Hargis Bayou, a large overflow channel, occurs in section 11, T15N, R11W (Plate 3). Overflow channels probably experienced streamflow only during periods of high discharge in the raft distributary channels.

33. Natural levee. Natural levees are one of the most pervasive features in the project area. Most large alluvial rivers develop levees naturally adjacent to the convex side of meanders. The Red River has an unusual propensity for natural levee production due to its high load of silt-size sediment and its aggrading condition, characterized by a broad, thick belt of natural levee on both sides of its meander channels, both active and abandoned. As the streambank is overtopped during floods sediment-laden water rapidly decreases in velocity as it flows away from the channel. Consequently, its sediment load is quickly depleted, dropping the coarsest particles out nearest the channel. This results in a wedge-shaped deposit of fine sand, silt, and clay adjacent to the channel, decreasing in thickness, surface elevation, and mean grain size with increasing distance from the channel. Natural levee crests in the project area may be as much as 10 feet above adjacent backswamps and 1 mile wide. Extensive natural levee deposits of the present Red River cover much of the N-1/2, section 8, R11W, T15N (Plate 2).

34. Crevasse. Crevasses are similar to natural levees in that they are relatively coarse sediments deposited overbank adjacent to the channel during flood flows. Crevasses differ from natural levees in areal extent. Crevasses are localized fan-shaped wedges of sand and silt (fining away from the channel) formed during high energy overbank flows through a breach in an existing natural levee or streambank. In some instances (convex side of a tortuous meander), large crevasses occur which develop anastomosing channels extending for several miles away from the active channel. Numerous large crevasses occur on the Red River floodplain. A large crevasse, covering several square miles, blankets the floodplain surface adjacent to the Red River in the southwest corner of the Sligo quadrangle (Plate 1). A small crevasse is mapped in the SW-1/4, section 36, T15N, R11W (Plate 4).

35. Point bar. Point bars are the product of lateral migration of alluvial streams. They occur on the concave (inside) bank of stream meanders opposite from the cutbank, or eroding edge of the meander. Formed through the welding of lateral sand bars onto the accreting bank, their resulting morphology is a crescentic washboard of alternating

parallel ridges and swales. The silty sandy ridges are the abandoned lateral bars. The swales are the low areas between the parallel ridges and usually fill with slack-water (low energy) deposits of silt and clay layers.

36. Point bar deposits exist in numerous locations throughout the project area, usually occurring inside the meanders of the active channel and abandoned courses and channels. The identification of these deposits is hampered in some areas by thick masking from vertical accretion of natural levee, crevasse, and raft deposits. In some cases, point bar deposits are almost completely surrounded by abandoned channels and courses. The abandoned channels and courses act as sediment sinks, partially protecting the point bar from burial by vertical accretion deposits (natural levee) from an adjacent stream. Such is the case of the point bar deposits visible on the inside of the meander in the N-1/2, section 7, T14N, R10W (Plate 4).

37. Backswamp. In most alluvial floodplains, the antithesis of the point bar is the backswamp. Whereas the point bar is formed by lateral accretion of relatively coarse-textured sediments (silt, sand, and gravel), the backswamp is a product of vertical accretion of silts and clays between the elevated meander belts. Collectively, they comprise most of the floodplain of "mature" alluvial valleys.

38. Backswamps are lower in elevation than the adjacent meander belts and are usually the locus of new channels formed by an avulsion (redirection of flow) of the old channel from its existing meander belt. During the existence of the raft in the project area, local backswamps were most likely constantly inundated. Presently, backswamps in the area are characterized by flat, broad, expanses of poorly drained, organic rich, fine-grained alluvium as seen in the SW-1/4, section 14, T15N, R11W (Plate 3).

39. Rimswamp. The internal stratigraphy, origin, and topographic expression of a rimswamp is similar to that of the backswamp. However, a rimswamp occurs between an elevated meander belt and the upland of the valley wall. Examples of rimswamps are shown on Plate 3.

40. Valley margin lakes. At the point of juncture of large tributary valleys and the Red River Valley, the remnant surfaces of large lakes are often apparent. Veatch (1906) believed these lakes to be products of backwater flooding during the blockage of the Red River by the Raft. It is now apparent that their formation also has been strongly influenced by differential filling of the Red River and tributary valleys. As aggradation proceeded at a rapid rate in the Red River Valley, the tributaries were unable to fill their valleys at an equal rate, resulting in blockage of the mouth of the tributary valley. This phenomenon is readily apparent in the positive down-valley gradient of the Loggy Bayou floodplain. Valley margin lakes have been affected by removal of the Raft (and the Rapides) as recent degradation of the Red River channel is rejuvenating incision of the tributary streams, effectively draining the valley margin lakes. Only local artificial dams and levees across tributary valleys have preserved the once abundant valley margin lakes.

41. Upland scarps. The floodplain of the Red River is bounded by upland scarps, rising as much as 100 feet above the adjacent floodplain. Usually a highly dissected steeply sloping surface, the adjacent uplands are composed primarily of alluvial sediments of the Prairie terrace developed during the Sangamon interglacial by the Red River. In the vicinity of Loggy Bayou in the southern extent of the project area (Plate 4), the upland slopes are developed in Wilcox sediments of Eocene age.

42. Historic accretion deposits. Adjacent to the present Red River is a complex mosaic of truncated chutes and bars developed in historic times, primarily during the last 40 years. The environment is a combined product of lateral migration and channel metamorphosis toward a braided channel configuration. Frequently modified by high stages of the river, this environment is contained primarily within the artificial levees.

Interpretation of the geomorphic maps

43. Interpretation of the alluvial landscape shown on the geomorphic maps reiterates previous statements concerning the complexity of

the geomorphic development of the Red River floodplain. A major condition of the Red River floodplain, which is uncharacteristic of most alluvial valleys, is the preponderance of overbank or vertical accretion (natural levee, crevasse, and backswamp deposits) versus lateral accretion (primarily point bar) deposits. Most floodplains consist of approximately 10 to 20 percent vertical accretion and 80 to 90 percent lateral accretion deposits (Wolman and Leopold, 1957). Vertical accretion deposits in the project area of the Red River floodplain may account for as much as 45 percent of the total alluvial fill. This atypical condition of the Red River is paramount in estimating the archaeological significance of geomorphic features of the project area, both individually and collectively.

44. The presence of three meander belts of the Red River dominates the floodplain in the area. The oldest belt, labeled A on the geomorphic maps, is typified by meander scars which are slightly wider than those of meander belt B. Meanders of belt A are also of greater amplitude than those of belt B. Additionally, belt A appears to have existed during a Red River regime that created abandoned channels instead of the abandonment of course segments which often occurred when meander belt B was active. A logical suggestion is that meander belt B was more geomorphically stable than belt A.

45. Meander belt C is the modern Red River. Some of the abandoned channels of this belt were abandoned during historic times. As previously mentioned, the sinuosity of the historic Red River has been sharply reduced in the last 50 years, especially between section 22, T16N, R12W (Plate 2) and section 3, T14N, R11W (Plate 4), due to channel degradation, as shown by Abington (1973). Generally, the modern meander belt (C) contains abandoned channels which appear to be similar in width and amplitude to meander belt A. The relative age of abandoned channels of a single meander belt is identified where apparent, with the oldest channels denoted by the subscript "1." It must be stressed, however, that this relative chronology is only valid locally. All abandoned channels denoted by the same symbol are not necessarily contemporaneous. Abandoned channels of Loggy Bayou, developed as Loggy Bayou periodically

meandered out of the old Red River channel below High Island (Plates 3 and 4), are denoted by the letter "L."

46. Point bar deposits undoubtedly underlie much of the Red River floodplain, as well as the inside of abandoned channels and courses. The difficulty in discriminating these deposits from long enduring backswamps arises from the atypical quality of the Red River to rapidly ag-grade its floodplain, masking the less conspicuous ridges and swales which are diagnostic of the point bar environment. Consequently, boundaries between backswamps and point bars have not been delineated on the outside of abandoned channels. However, as a general rule, point bar deposits should be expected to occur on the inside of meanders, with the probability of deep backswamp deposits underlying natural levees being much greater on the outside (convex side) of the meander. The general exception to this is the case of nested meanders (SW-1/4, section 2, T15N, R11W, Plate 3; NW-1/4, section 7, T14N, R10W, Plate 4; SE-1/4, section 22, NE-1/4, section 35, T15N, R11W, Plate 3). Where point bars, backswamps, and rimswamps have been positively identified, they are denoted by the symbols PB, BS, and RS, respectively, on the geomorphic maps.

47. Relatively thick (8 to 10 feet) natural levees flank most of the abandoned courses and abandoned channels. However, abandoned channels of meander belt A exhibit a lesser degree of adjacent natural levee development. It is probable that natural levees of belt A are buried beneath more recent backswamp deposits from belts B and C. Indeed, results of the hypsometric analysis reveal a well defined westward increase in the elevation of natural levee crests from belt A through belt B to belt C.

48. A peculiar condition of the southern end of the project area is the paucity of natural levee deposits along Flat River (belt B) from Red Chute Bayou to Toulon Bayou (Plates 3 and 4). This reach of the channel of meander belt B appears to have been more deeply incised (possibly due to local geologic controls on its bed), containing sediment-laden stream flow until it reached the vicinity of the northern tip of Alligator Bayou (probably a previous channel of belt B). Below this

point it easily breached its channel, developing a thick wedge of natural levee deposits in sections 19 and 20, T14N, R10W (Plate 4).

49. A general lack of natural levee development is distinctive of raft distributary channels in the area. Several prime distributary channels that developed during the raft exist in the region. The largest is Red Chute Bayou between Cross Bayou and Flat River. During the existence of the Raft, abandoned courses of meander belt B acted as distributary channels. At the bend in the channel which is now the confluence of upper Red Chute Bayou and Cross Bayou, the Red River breached its channel, distributing part of its discharge down through an adjacent rimswamp, the present site of Red Chute Bayou south of Cross Bayou. As previously mentioned, Flat River Ditch, as well as a segment of Flat River in sections 13 and 24, T16N, R12W (Plate 2), was formed as a raft distributary channel. Most of the raft distributary channels in the area have been channelized in order to increase their hydraulic efficiency, resulting in the development of spoil piles and artificial levees on one or both sides of the channel.

PART III: ARCHAEOLOGICAL SIGNIFICANCE OF THE GEOMORPHIC
DEVELOPMENT OF THE RED RIVER FLOODPLAIN

Potential Contributions of Geomorphic Analyses

50. As a precursor to the cultural resource survey, a comprehensive geomorphic analysis can provide the archaeologist with at least three major types of information that may contribute significantly to the design of a survey strategy. The three major types of information are: (a) definition and delineation of geomorphic features, (b) development of a chronology (probable maximum age) of geomorphic features, and (c) the probability of the existence of buried geomorphic features of archaeological significance. This investigation was planned to provide the archaeologist with all three types of information, plus recommendations for a survey strategy in the immediate project area.

Definition and Delineation of Geomorphic Features

51. The definition of environments of the project area, in terms of location, physical characteristics, and origin was determined from all available data sources. Descriptions of the twelve types of geomorphic features which are believed to be significant in an archaeological context are given in Part II. The distribution of the geomorphic features is depicted on the geomorphic map (Plates 1, 2, 3, and 4).

Chronology of Geomorphic Features

52. Development of a reasonably accurate chronology for the geomorphic development of an area is dependent upon the completion of two tasks, the reconstruction of the geomorphic development of the area (previously discussed in Part II) and the assignment of the developmental phases to certain time periods. The first task was accomplished in a direct manner from reliable data sources. Completion of the second task was more elusive, requiring detailed examination of all

logistically available data sources that might contain a reasonably accurate and appropriate temporal dimension.

53. Establishment of the ages of the meander belts, most likely the prime loci of prehistoric cultural occupations, was the primary goal of the development of a geomorphic chronology. The following chronology is based upon data development by this investigation and correlations to other geomorphic features which have been chronologically defined. A substantial part of the chronology is the product of the extrapolation of the Red River floodplain developed by Russ (1975).

54. As suggested by its topographic position (elevation), geographic location, surficial expression, and soil geomorphology, meander belt A predates belt B. Topographically, the natural levee crests of meander belt A are lower than those of belt B. Geographically, belt A is east of belt B. The general trend of the Red River throughout the Holocene has been to shift to the west. The salient features of meander belt A (abandoned meanders, point bars, and natural levee) appear to be more extensively buried than those of belt B.

55. According to descriptions of typical vertical profiles of soils developed in natural levee deposits adjacent to the meander belts, the soils developed in the natural levees of meander belt A are more pedogenically mature than those developed in the natural levees of meander belt B. Meander belt A natural levee soils typically contain moderately developed distinctive soil horizons, especially a textural "B" horizon containing a significant percent of translocated (illuviated or leached down from the A horizons) clay particles, a process which usually takes a significant amount of time. Soils developed in natural levees of meander belt B are generally "A-C" soils that have not had sufficient time to develop a textural B horizon.

56. Correlation of the meander belts of the Red River floodplain in the Shreveport area with the meander belts identified by Russ (1975) in the lower Red River provides a means of assigning absolute ages (time

spans) to the meander belts in the project area.* Meander belt A is correlated with meander belt number one of Russ, assigning it an age of about 6200 to 7000 years (Russ, 1975). Russ' meander belt number two is correlated with belt B in the project area and therefore is considered to be 4500 to 6400 years old. The modern meander belt (C) is considered by Russ (as meander belt number five) to be about 600 years old. In the project area, meander belts three and four of Russ, representing the period from about 4500 to 600 years ago, are located west and possibly in the vicinity of the present Red River. On the map, a relative chronology for abandoned channels is given within each meander belt, with the subscripts 1 representing the oldest and 4 the youngest abandoned channel.

Probability of Buried Archaeological Sites

57. The probability of the occurrence of buried archaeological sites is substantial in most "mature" alluvial valleys. Considering the probable occupation of the Red River floodplain by prehistoric cultures at various locations throughout the Holocene (last 12,000 years) and the amount of floodplain sedimentation which has occurred during the same period, it is logical to assume that the probability of occurrence of buried archaeological sites in the Red River floodplain is high. As previously stated, it appears that the Red River has aggraded its floodplain as much as 60 feet in some areas in the last 18,000 years. As sea level rose to near its present level about 5000 years ago, the Red River Valley aggraded at a rate which gradually decreased throughout the late Wisconsinan and the Holocene. If Russ' estimations of average sedimentation rates in the valley are reasonable (when extrapolated to the project area, they average about 3 feet per 1000 years over the last

* The correlations made between meander belts of the project area and those identified by David Russ were made in consultation with Fred L. Smith, Geotechnical Laboratory, WES, coauthor with Russ of "Geological Investigation of the Lower Red River - Atchafalaya Basin Area," the foundation of Russ' Ph.D. thesis on the geomorphology of the Red River.

11,000 years) then depths to certain cultural horizons (representing locally recognized cultural components) in a deeply stratified site in the project area, receiving average overbank sedimentation (a lower slope of natural levee) might be as follows:

Bossier Focus (1300 AD)	2.0 feet
Alto Focus (700 AD)	3.9 feet
Marksville (1 AD)	5.9 feet
Fourche Maline/Tchefuncte (500 BC)	7.5 feet
Late Archaic (1000 BC)	9.0 feet
Middle Archaic (5000 BC)	21.0 feet
Early Archaic (9000 BC)	27.0 feet
Paleo Indian (11000 BC)	33.0 feet

Cultural stratigraphic units in old backswamp areas would be more deeply buried than the above example. Conversely, sites situated on old natural levee crests (as much as 10 feet higher than the adjacent backswamps) would be buried by much less sediment.

58. Possible deeply buried sites are not unreasonable to suspect when one considers the stratigraphy of the Connley site (16BI19), which consists of approximately eleven feet of fine-grained (clayey) deposits (probably backswamp) overlying a middle Archaic horizon.* Located adjacent to Loggy Bayou (NE-1/4, SE-1/4, section 29, T15N, R10W), the Connley site is near the boundary between the Red River floodplain and Loggy Bayou Valley (Plate 3). Aggradation of Loggy Bayou has proceeded at a lesser rate than aggradation in the Red River Valley (hence the formation of Lake Bistineau).

59. The hypothesis of relatively deep burial would also aid in the explanation of the paucity of sites on the surface. After a survey of site files in the Environmental Branch, U. S. Army Engineer District, New Orleans, the only sites in the floodplain of the project area that were identified which contained cultural artifacts which predate Bossier Focus were sites 16-BO-14 (an Alto Focus site on a mound, located in SW-1/4, NW-1/4, section 36, T17N, R13W, not in the area mapped) and 16-BO-16 (located on a low terrace remnant, "High Island," containing Archaic, Alto Focus, and Bossier Focus components in NE-1/4, SW-1/4, section 19, T15N, R10W, Plate 3).

* Personal communication, 1982, Dr. Clarence H. Webb.

Recommendations for Survey of the Project Area

60. In designing a survey of the immediate project area, close attention should be paid to the geomorphic map, keeping the following conditions in mind:

- a. Red Chute Bayou from Cross Bayou to its juncture with Flat River is a raft distributary channel only, and as such is a relatively recent feature of the floodplain.
- b. Red Chute Bayou flows through the lowest (elevation) part of the project area (outside of the area of historic accretion deposits) and is subject to frequent inundation.
- c. No natural levees are apparent along Red Chute Bayou below Cross Bayou.
- d. The channel and upper banks of Red Chute Bayou below Cross Bayou have already been severely modified through historic channel improvement activities.
- e. Flat River and Red Chute Bayou north of Cross Bayou follow an abandoned course of the Red River which is thought to have been active 4500 to 6400 years ago. The Old Red River channel is now greatly reduced in size to accommodate Flat River and upper Red Chute Bayou.
- f. Natural levees along Flat River and upper Red Chute Bayou are probably partially buried by overbank deposits from the modern Red River and slack-water lakes of the Great Raft.
- g. Flat River has also been sporadically channelized, with spoil banks along much of its channel below Louisiana Highway 527.
- h. Many of the abandoned channels and accretion deposits adjacent to the modern Red River were developed in historic times.

In addition to these conditions, several assumptions of environmental preference of prehistoric cultures are made, including (a) proximity to streams or lakes, (b) protection from flood events of from high to moderate return frequency, and (c) at least a moderately well-drained soil.

61. In view of these conditions and assumptions, it is recommended that the project right-of-way be surveyed by boat from Curtis-Sligo Road to the point where the levee veers west across the floodplain to the present floodplain (SE 1/4, Sec. 7, T14N, R10W, Plate 4). Buried surfaces or paleosols should be noted where apparent and examined for

cultural artifacts. If possible, the surface along Red Chute Bayou from Cross Bayou to the Curtis-Sligo Road bridge in the project area should be examined by pedestrian survey. The top of the bank along the right-of-way of Flat River below Red Chute Bayou which is not covered by spoil should be examined by pedestrian survey, as should the right-of-way west to the river. The right-of-way of the levee "Lake Ninock to US Highway 71," should also be covered by pedestrian survey, excluding those areas of historic accretion deposits.

PART IV: CONCLUSION

62. The preceding geomorphic investigation of the Bayou Bodcau and tributaries project area was conducted to serve as a guide for estimating the potential location of cultural resources (archaeological sites) and to describe the environmental context of those sites which may be located during the subsequent cultural resources survey. Three major types of information were presented which should be considered in designing a survey strategy, including (a) definition and delineation of geomorphic features, (b) development of a chronology of geomorphic features, and (c) estimation of the probability of the existence of buried geomorphic features of archaeological significance. Using this geomorphic information and models of environmental preference for various cultural components, the archaeologist can design the most efficient survey strategy for determining the cultural resources of the impacted area.

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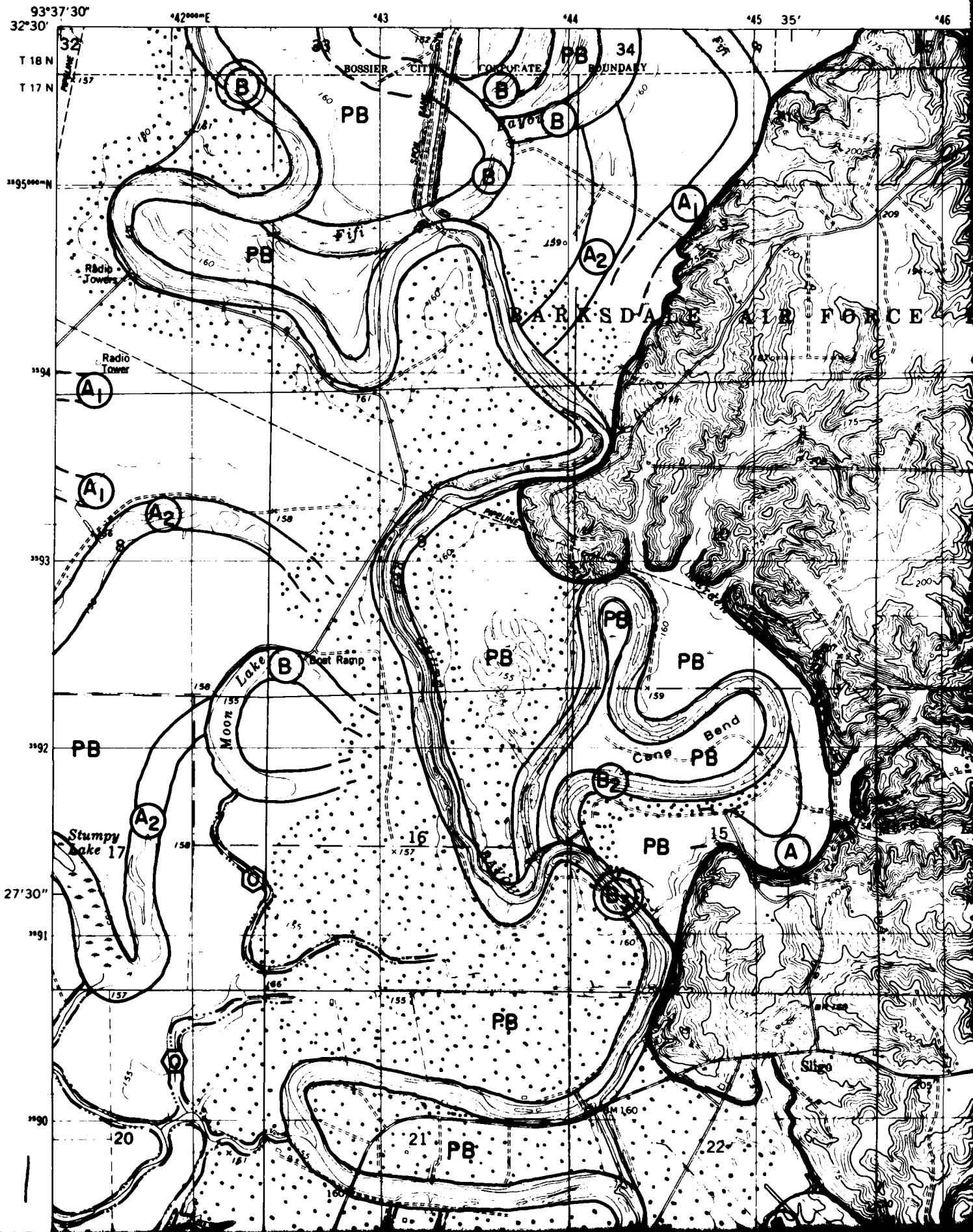
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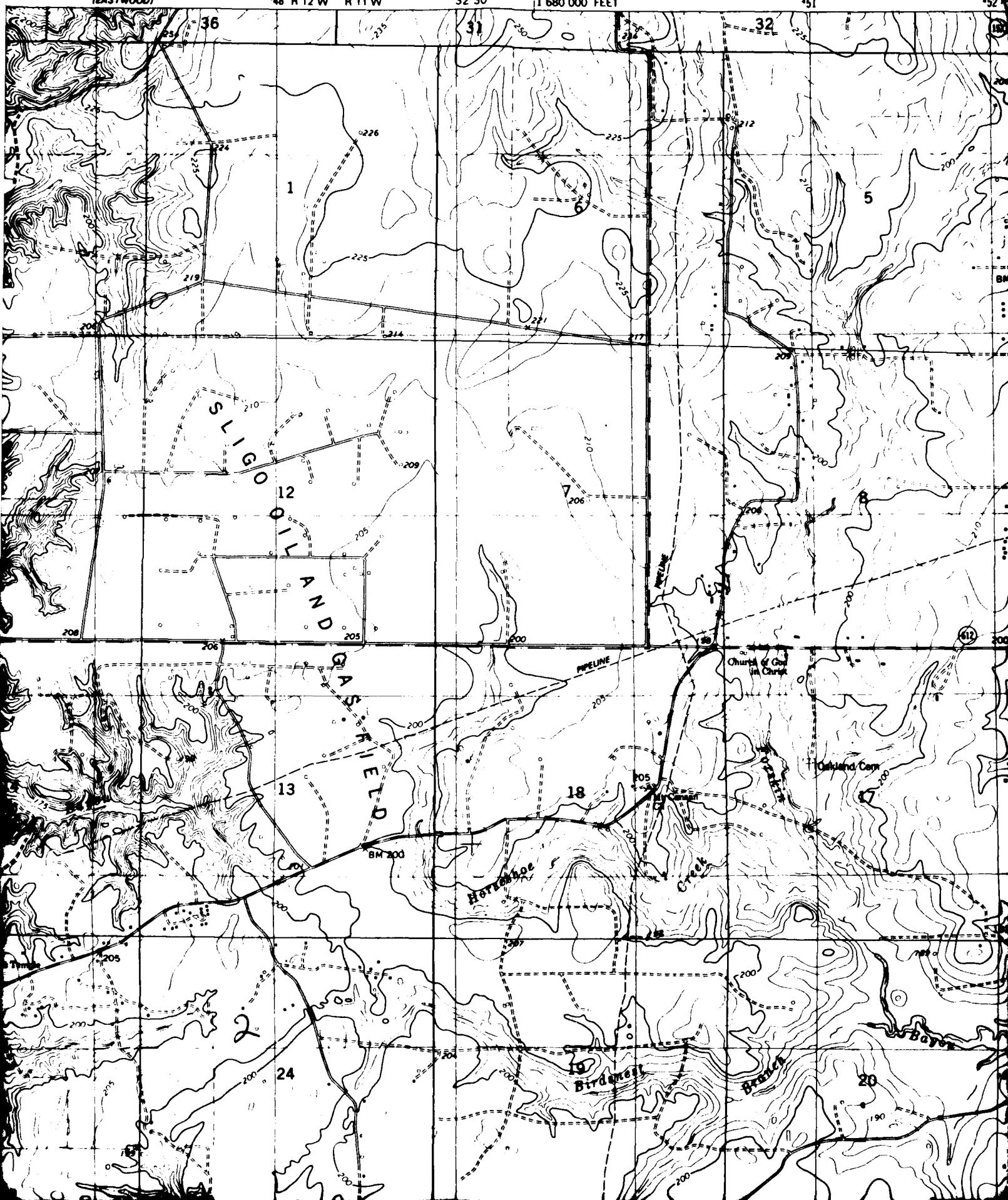
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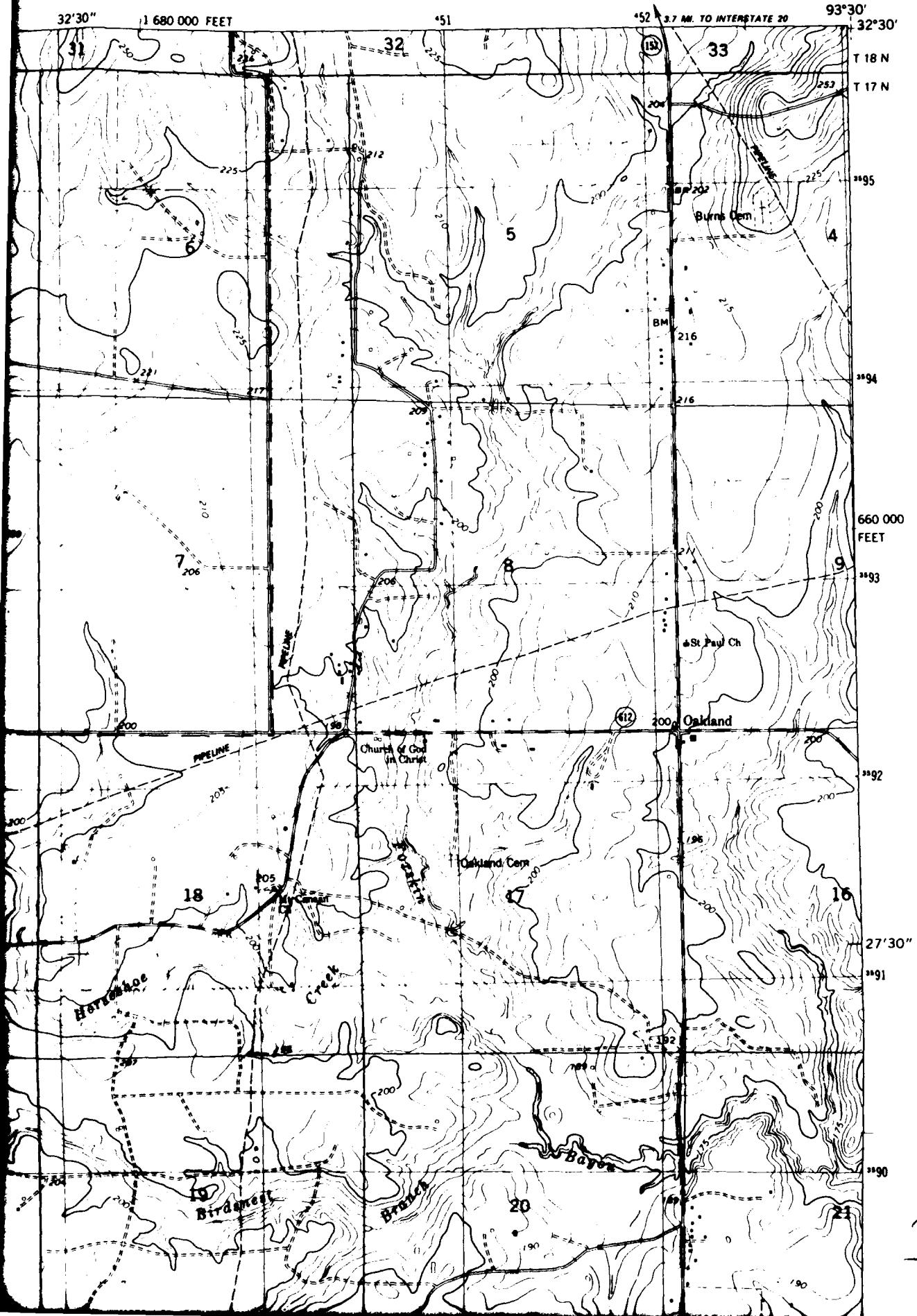
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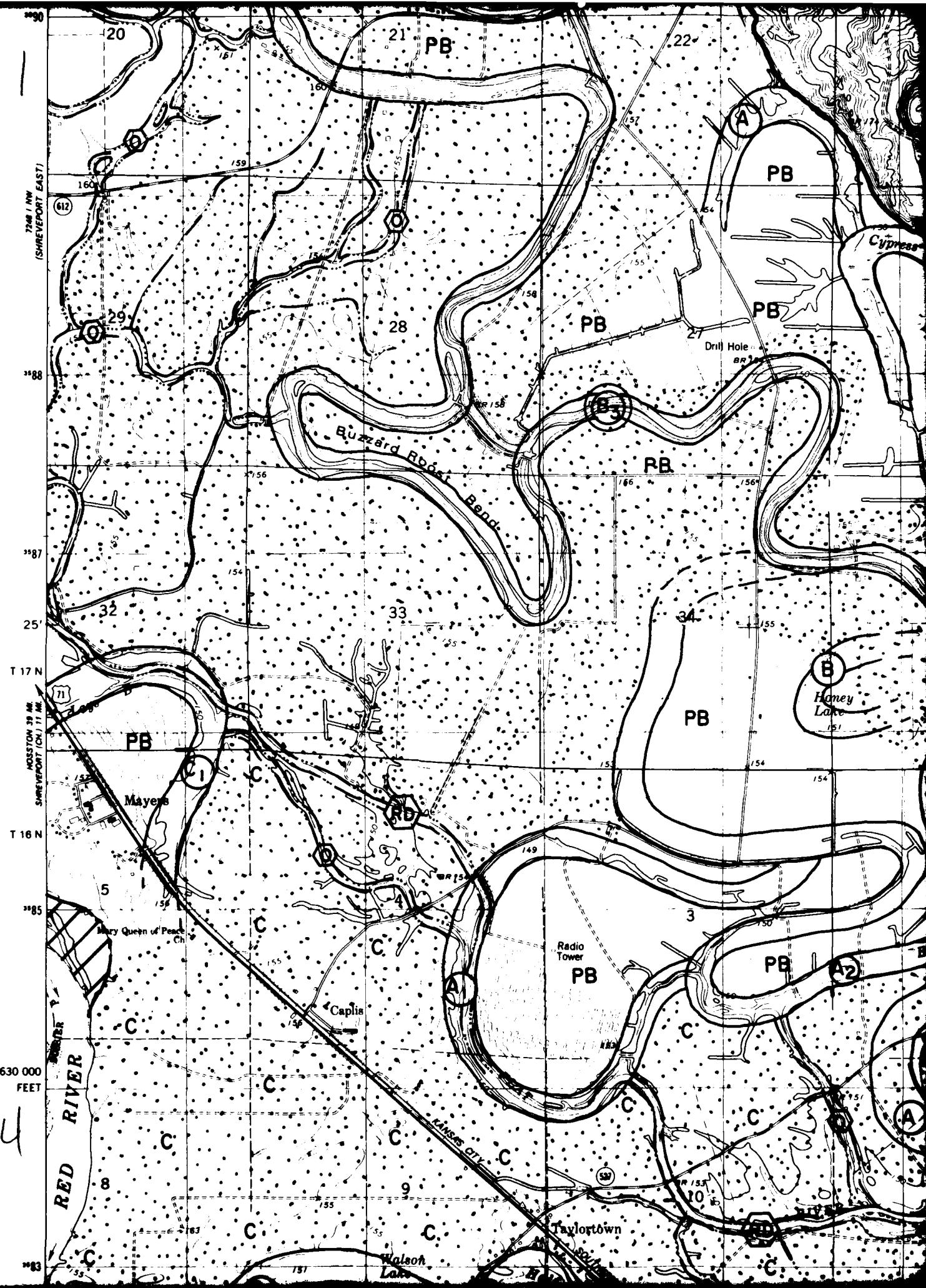
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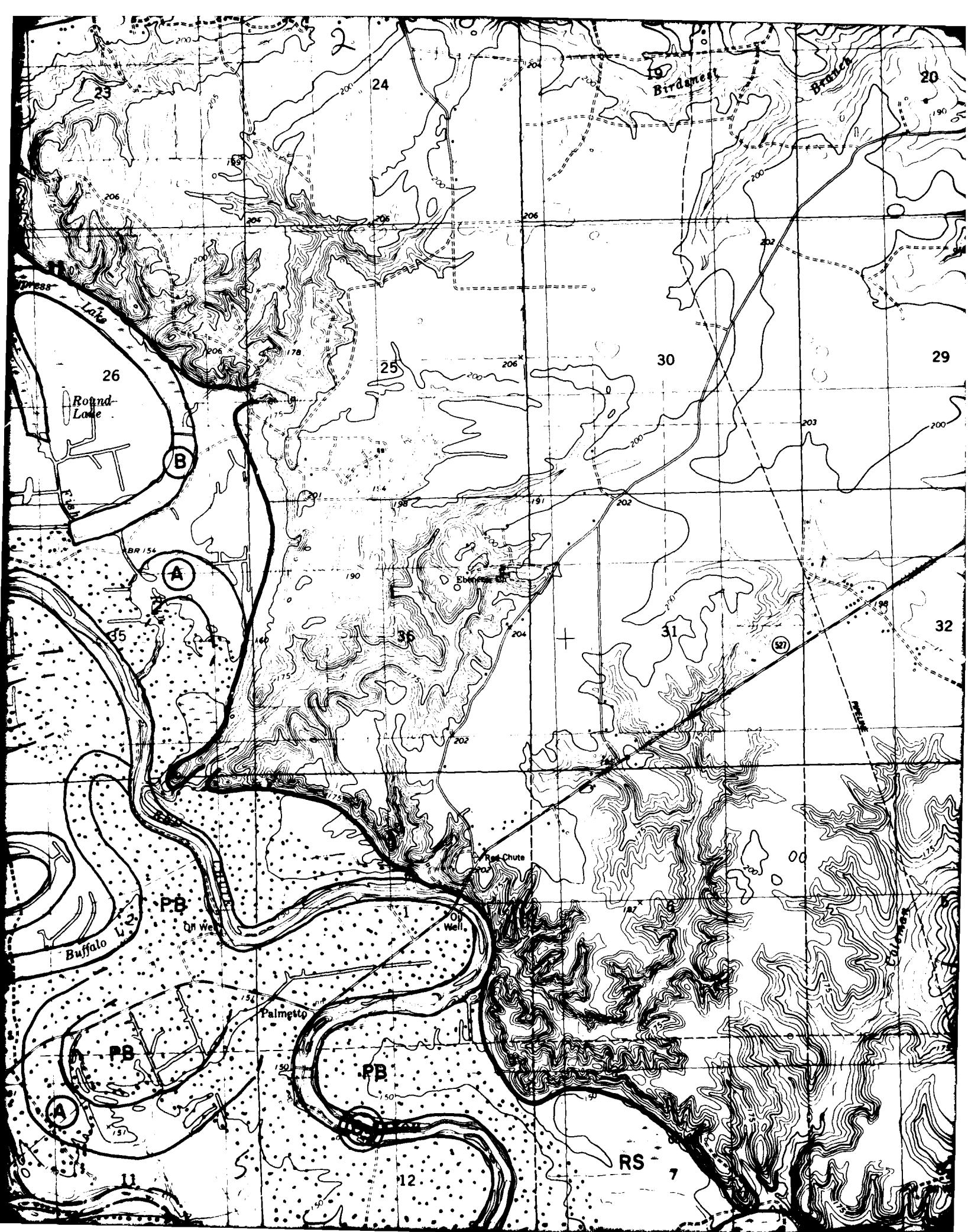


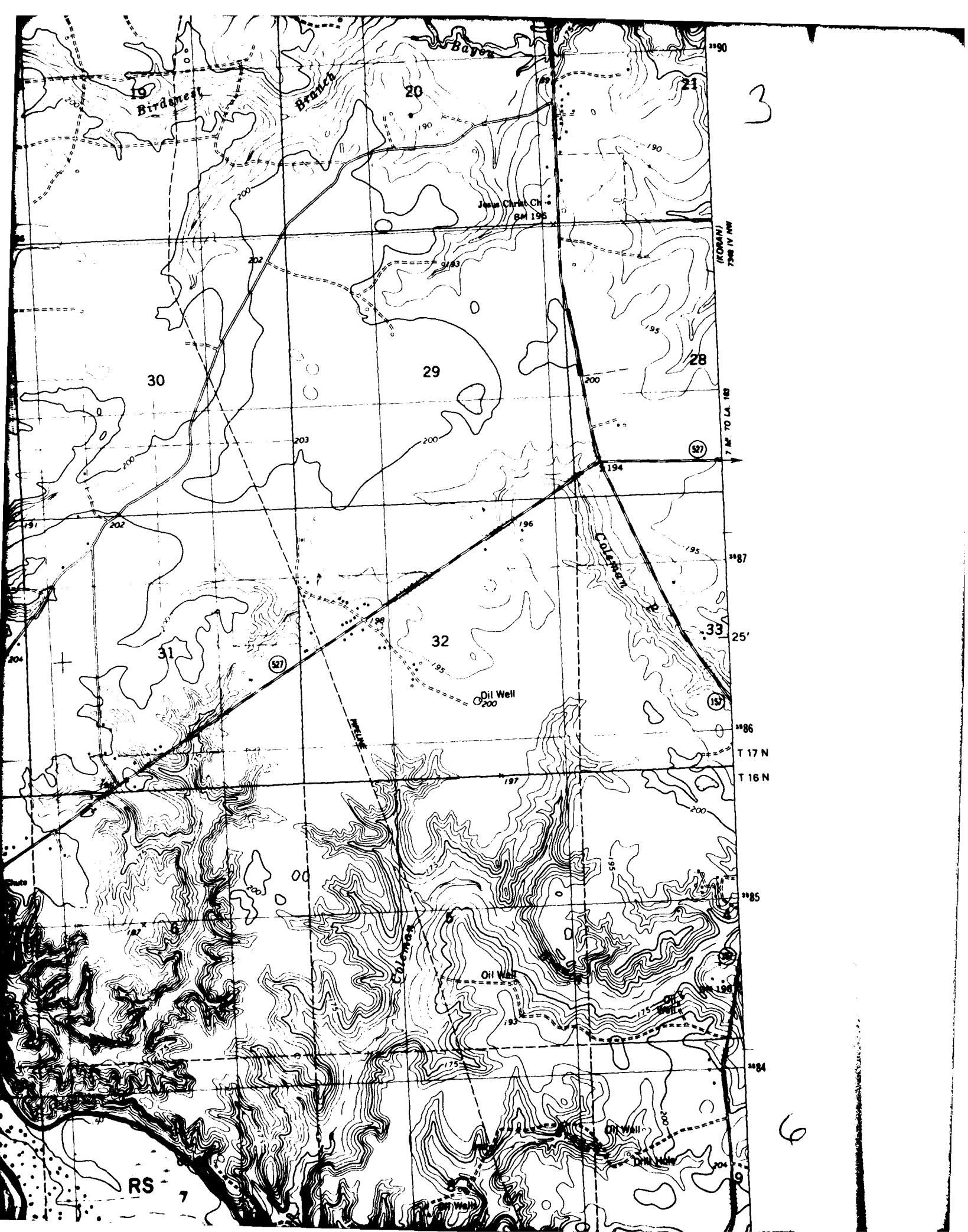
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LOUISIANA
7.5 MINUTE SERIES (TOPOGRAPHIC)
NE/4 CASPIANA 15' QUADRANGLE

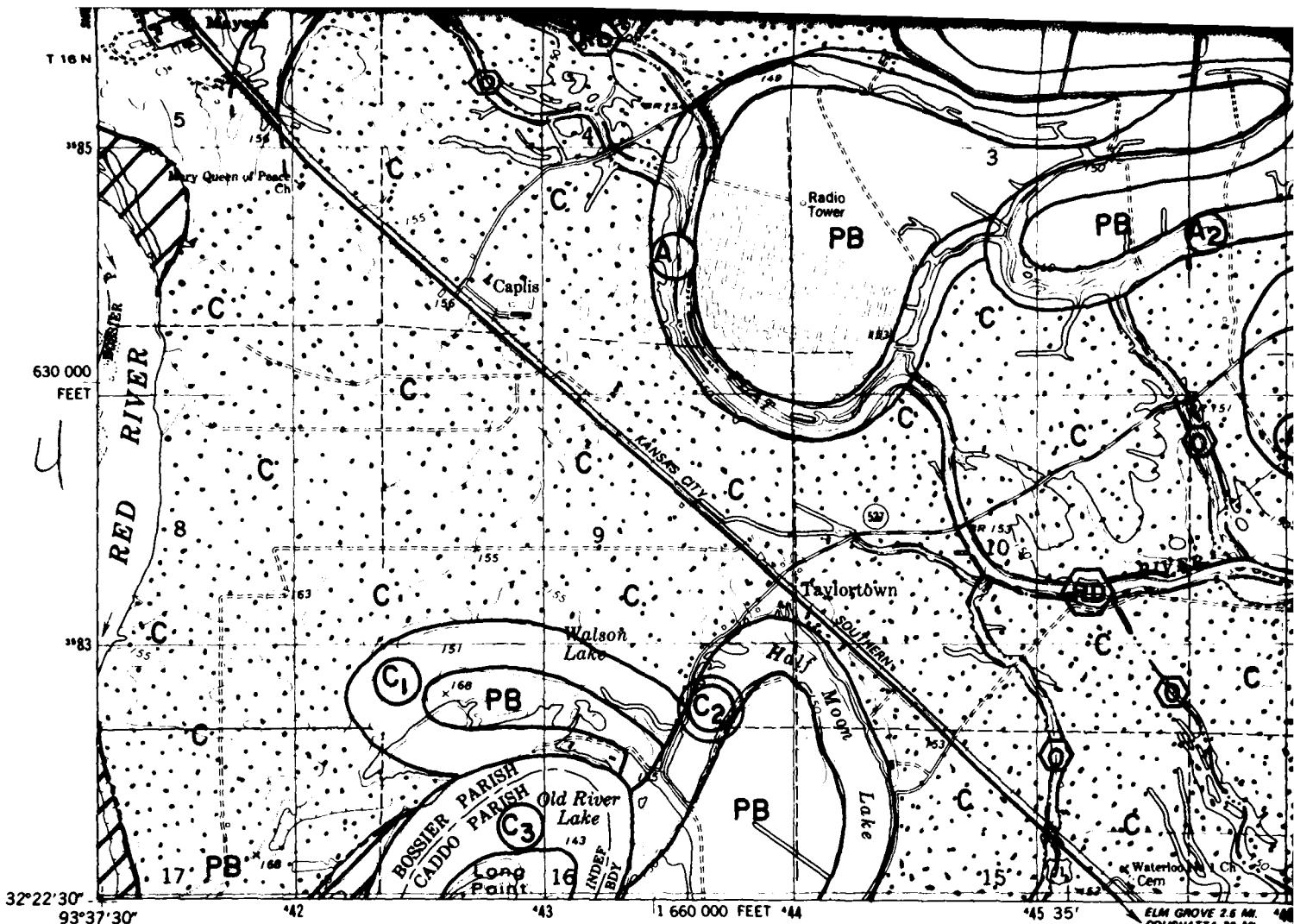
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Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1974. Field checked 1976. Map edited 1980

Projection and 10,000-foot grid ticks: Louisiana coordinate system, north zone (Lambert conformal conic)

1000-meter Universal Transverse Mercator grid, zone 15

1927 North American datum

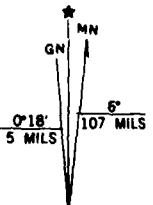
To place on the predicted North American Datum 1983

move the projection lines 12 meters south and

17 meters east as shown by dashed corner ticks

There may be private inholdings within the boundaries of the National or State reservations shown on this map

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked



FOR SALE BY U.
AND STATE OF
A FOLD

(A₁) Abandoned Channel

(O) Overflow Channel

BS

(A) Abandoned Course

(N) Natural Levee

RS

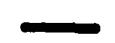
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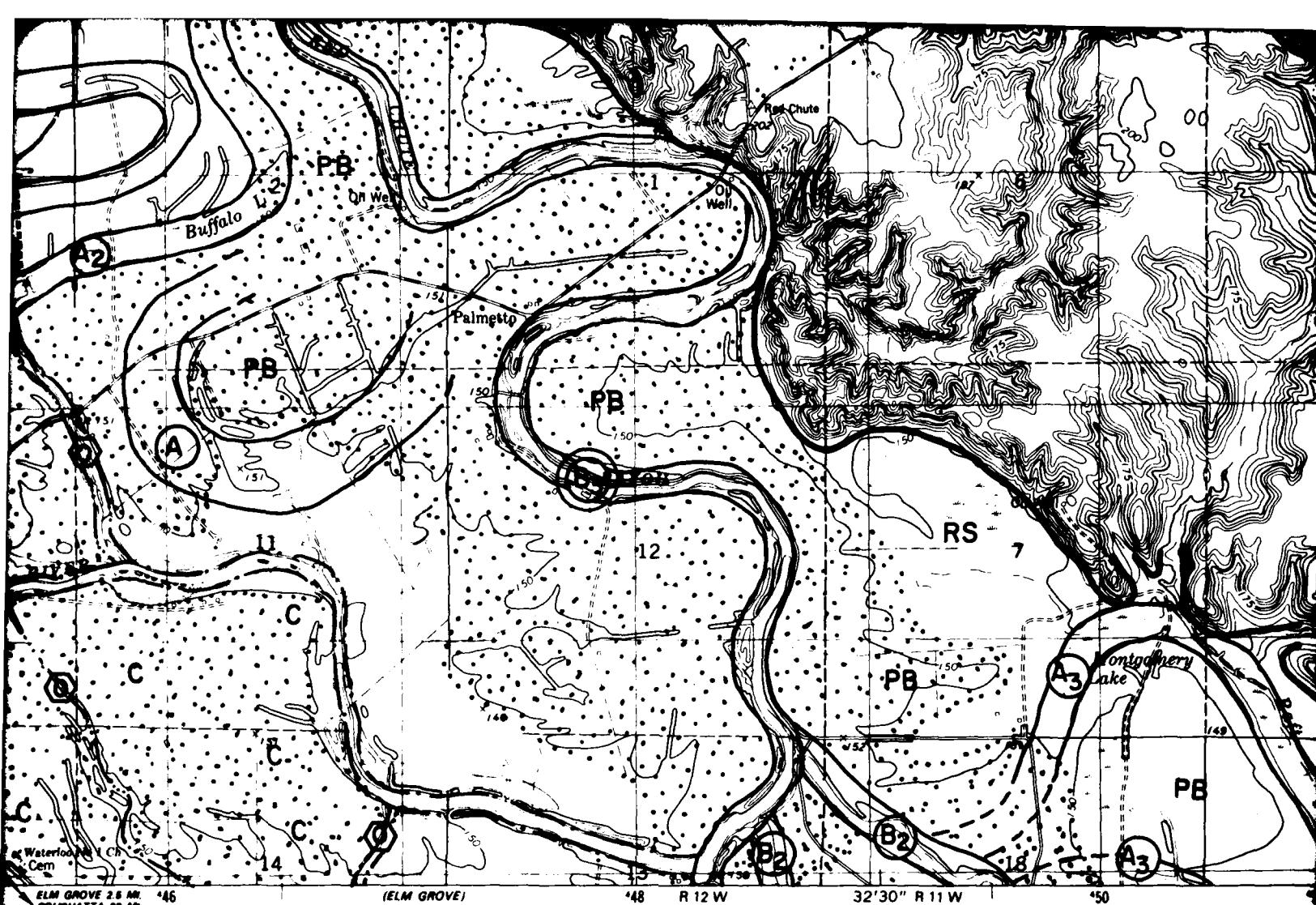
(C) Crevasse



(RD) Raft Distributary Channel

PB Point Bar





ELM GROVE 2.5 MI. '46

COUSHATTA 32 MI.

SCALE 1:24 000

48 R 12 W

32°30' R 11 W

50

PB

Waterford Cem.

Cem.

(ELM GROVE)
7200 1 SE

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0 5 0 1 KILOMETER

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929



QUADRANGLE LOCATION

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
AND STATE OF LOUISIANA, DEPARTMENT OF PUBLIC WORKS, BATON ROUGE, LOUISIANA 70804
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

BS Backswamp

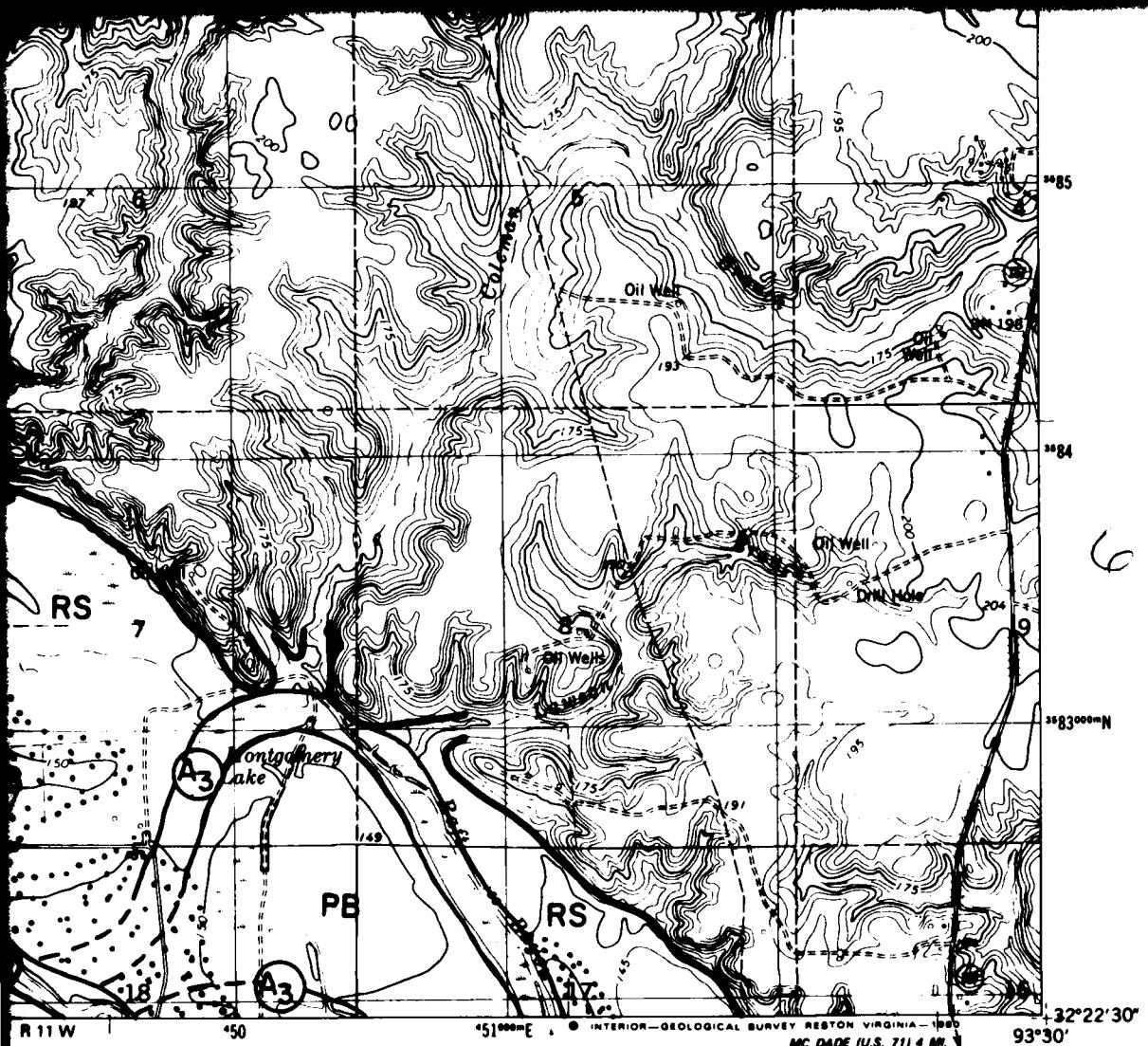
/// Historic Accretion Deposits

RS Rimswamp

QT_L Low Terrace

Valley Margin Lake

Upland Scarp



A simple line drawing of the state of Louisiana. A small black dot is placed in the northern part of the state, just south of the Canadian border. The word "LOUISIANA" is printed in capital letters across the middle of the state outline. Below the map, the text "QUADRANGLE LOCATION" is written in a bold, sans-serif font.

ROAD CLASSIFICATION		
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Secondary highway, hard surface	<input type="checkbox"/>	Unimproved road <input type="checkbox"/>
<input checked="" type="checkbox"/> Interstate Route	<input type="checkbox"/> U. S. Route	<input type="checkbox"/> State Route

SLIGO, LA.
NE/4 CASPIANA 15' QUADRANGLE
N3222 5-W9330/7 5

1980

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SLIGO, LA.

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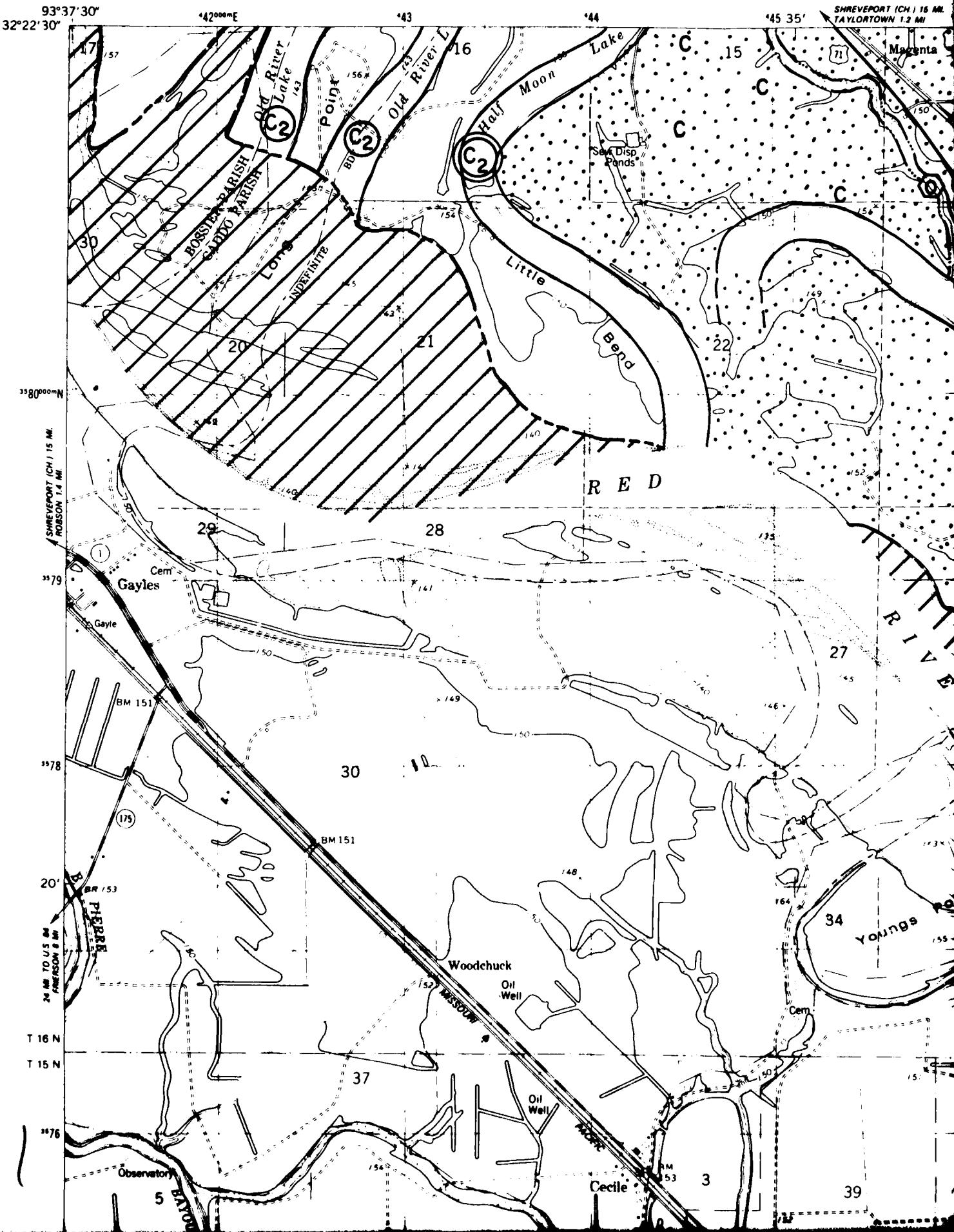
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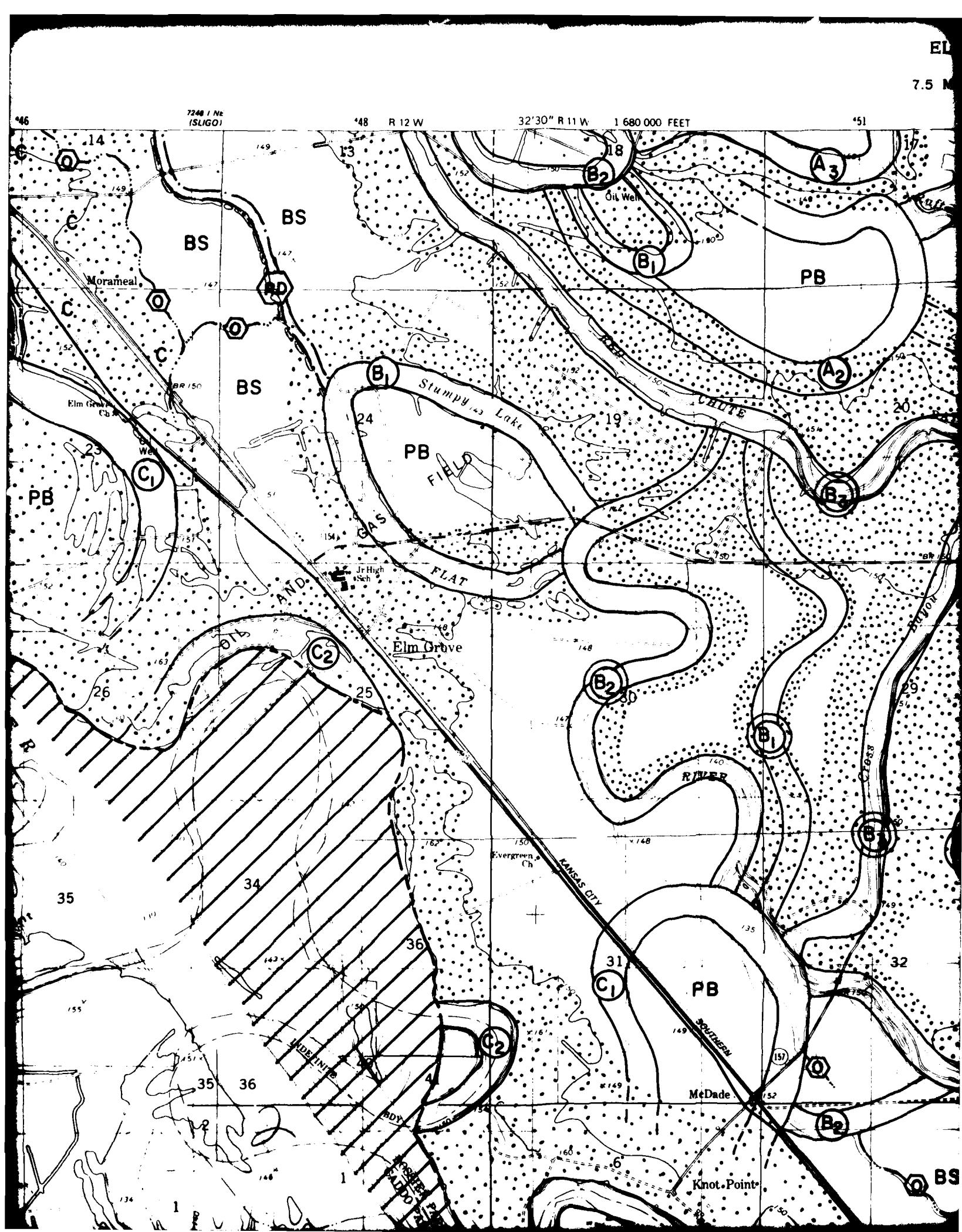
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Plate 1. Geomorphic Map, Sligo Quadrangle

UNITED STATES
DEPARTMENT OF THE INTERIOR
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1:250,000
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LOUISIANA
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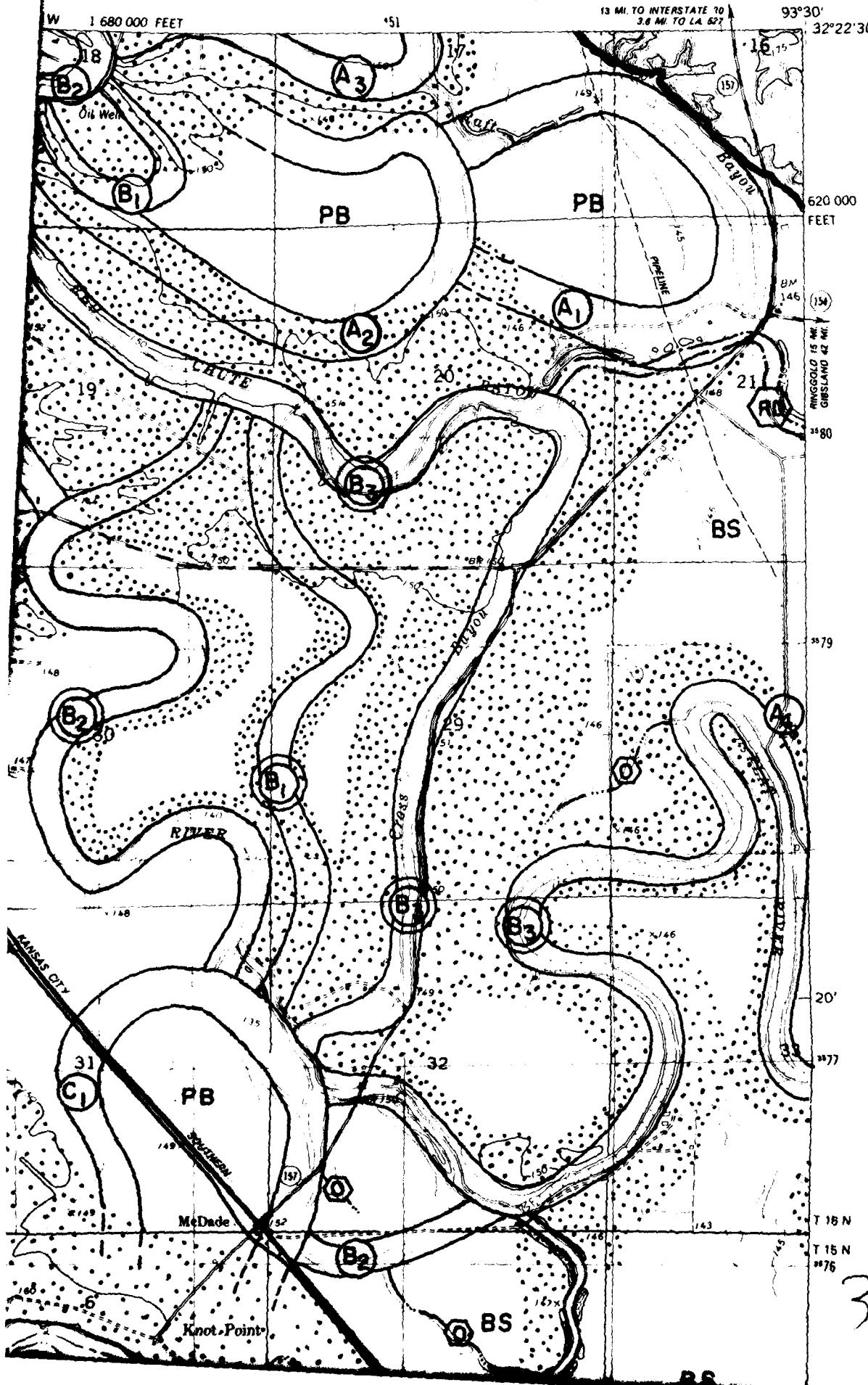
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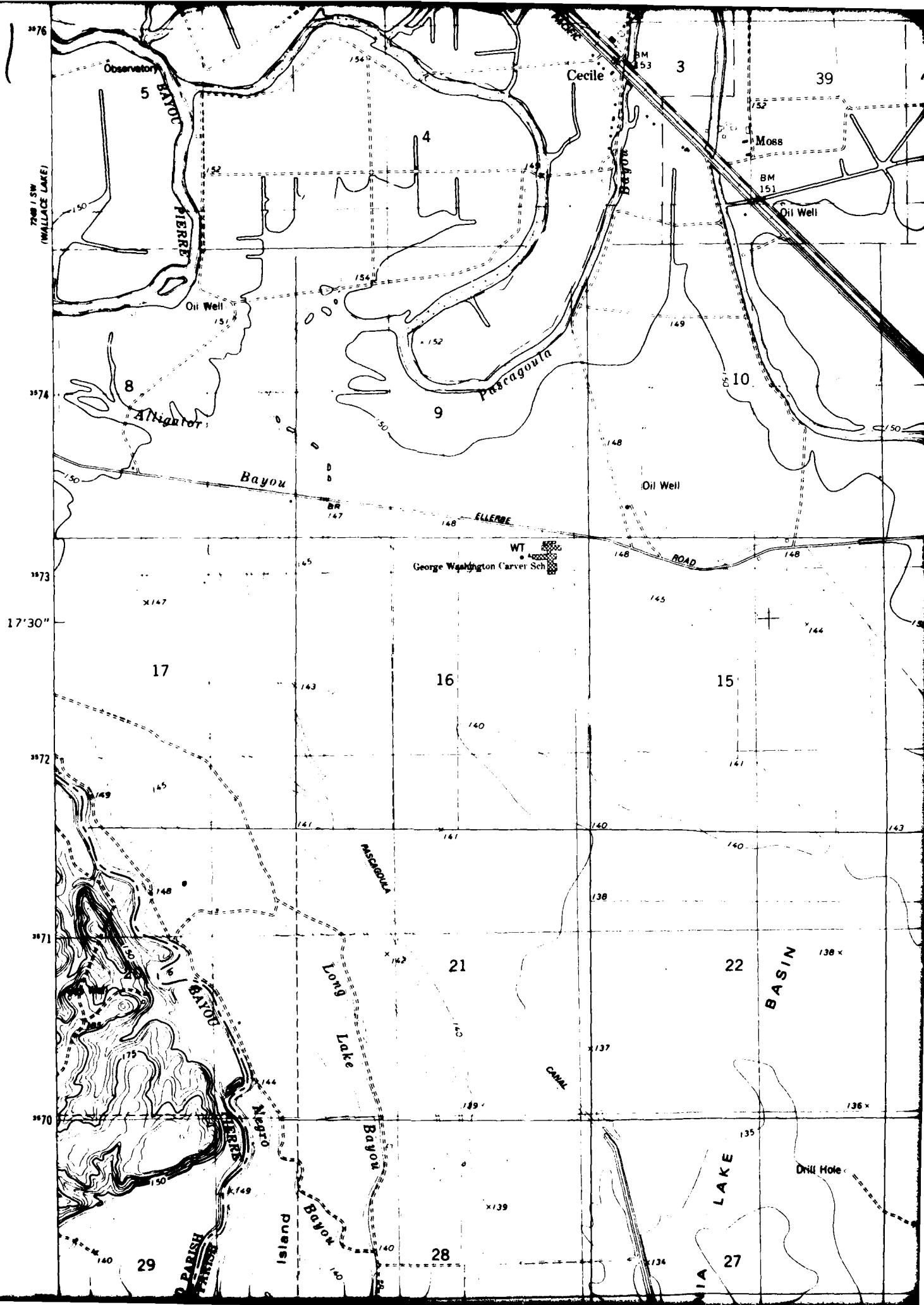
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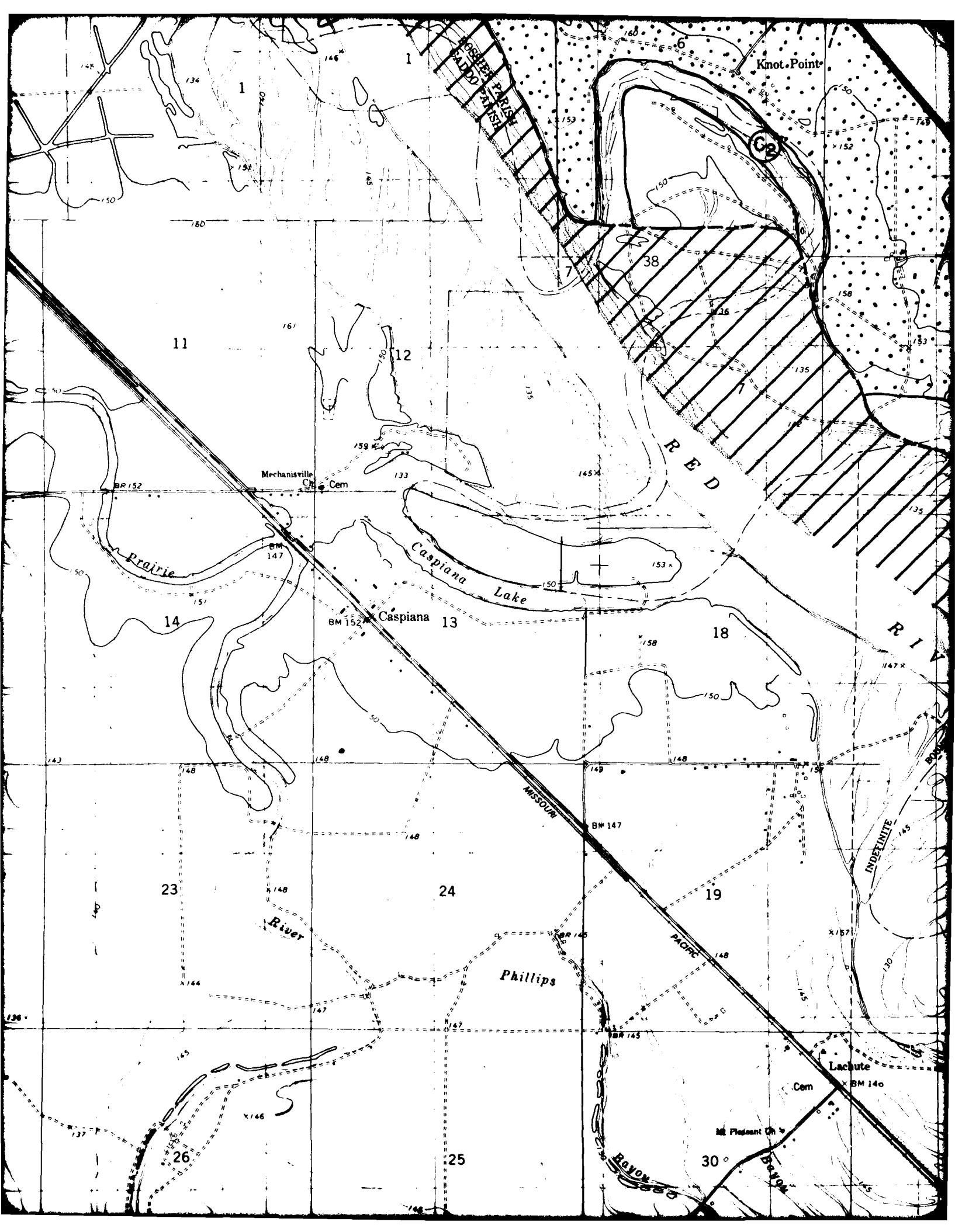
13 MI. TO INTERSTATE 20

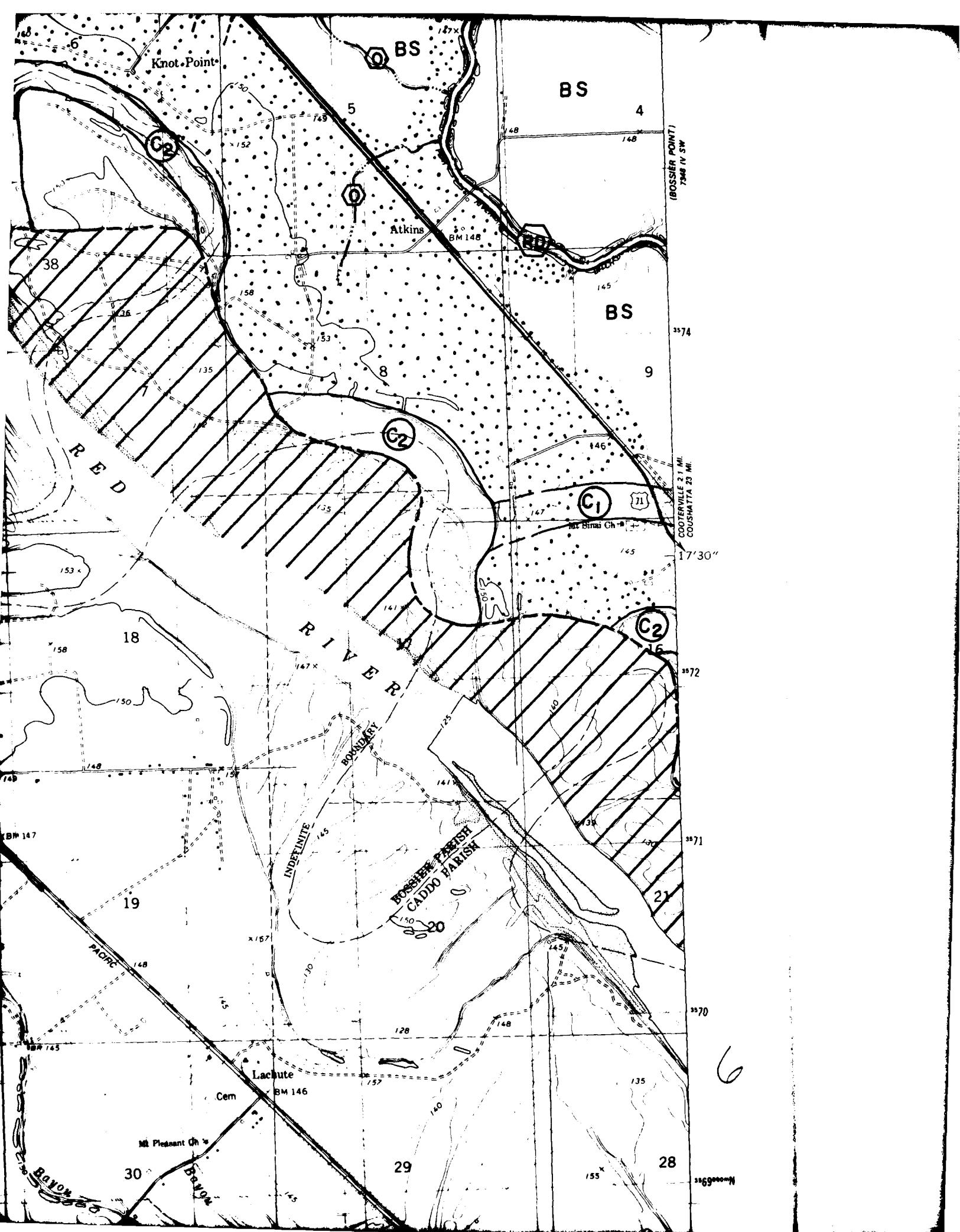
3.8 MI. TO LA. 627

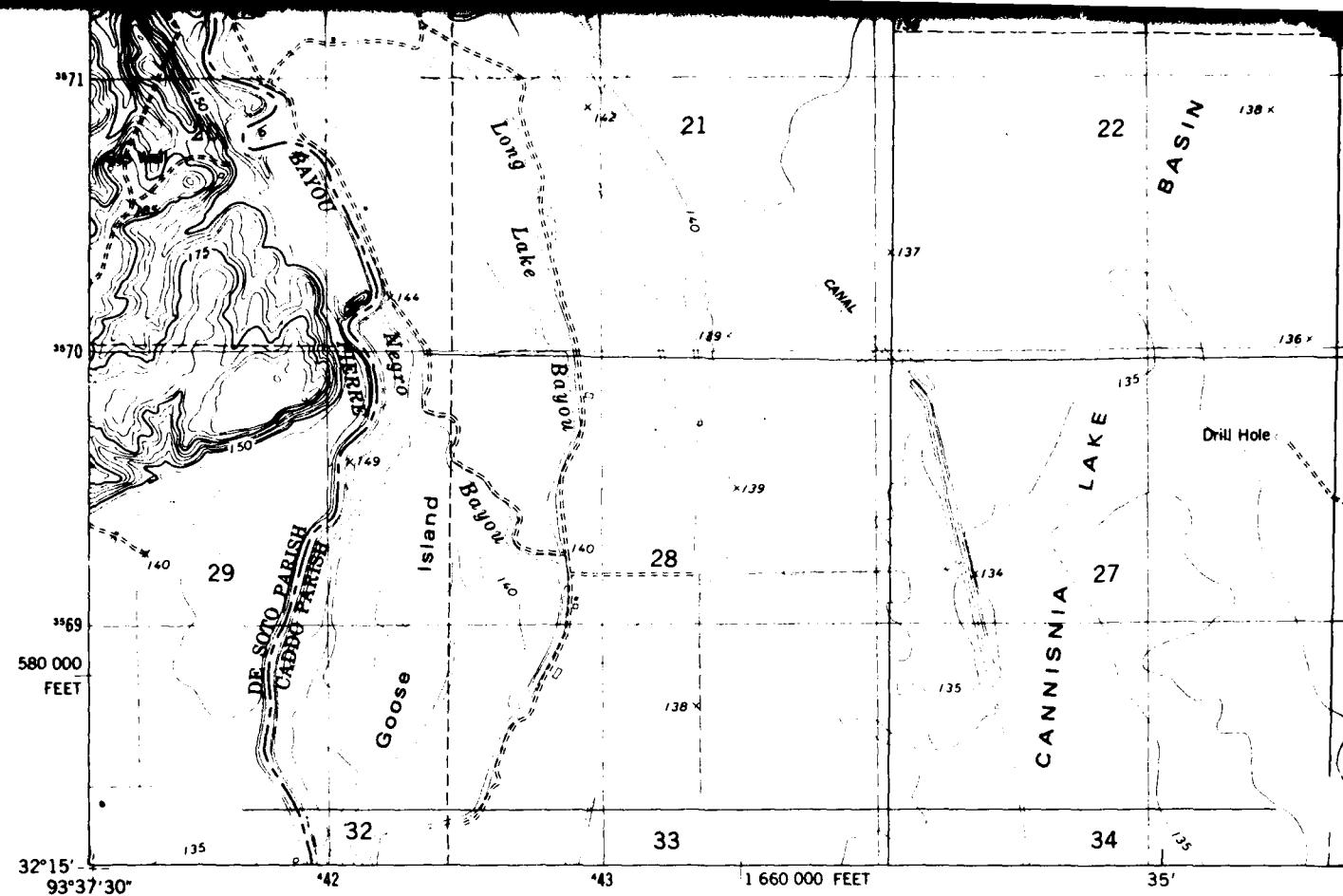
93°30'
32°22'30"











Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1974. Field checked 1976. Map edited 1980

Projection and 10,000-foot grid ticks: Louisiana coordinate system, north zone (Lambert conformal conic)

1000-meter Universal Transverse Mercator grid, zone 15

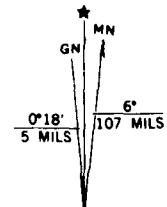
1927 North American Datum

To place on the predicted North American Datum 1983

move the projection lines 13 meters south and

17 meters east as shown by dashed corner ticks

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked



UTM GRID AND 1980 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

FOR SALE
AND STA

(A) Abandoned Channel

(O) Overflow Channel

(A) Abandoned Course

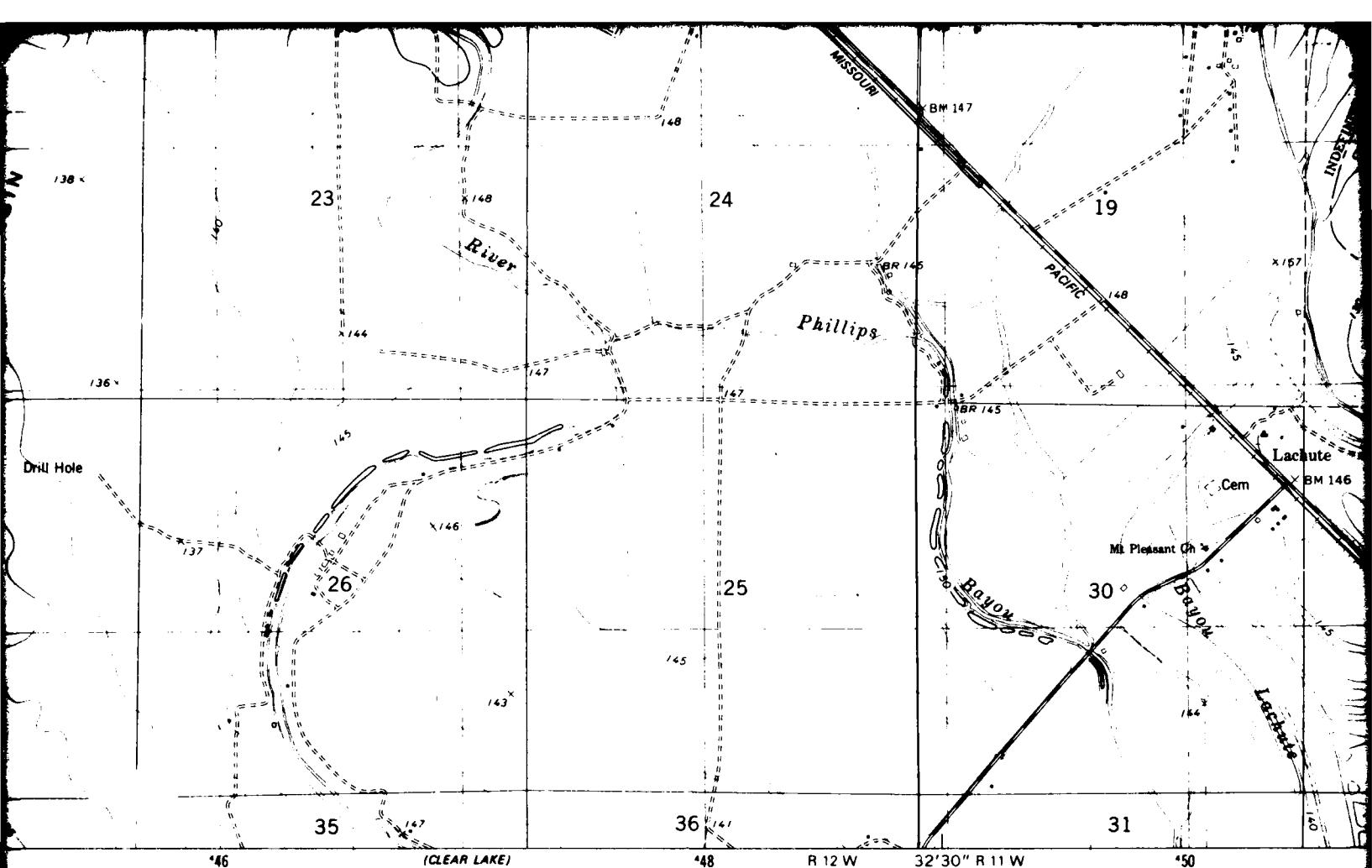
(N) Natural Levee

(L) Former Loggy Bayou

(C) Crevasse

(RD) Raft Distributary Channel

PB Point Bar



7248 II NE

46

1

44

R 1

32'30" R 11 W

450

SCALE 1:24 000

A scale bar for a 1:24,000 scale map. The top part shows distances in feet: 1000, 0, 1000, 2000, 3000, 4000, 5000, 6000, and 7000. The bottom part shows distances in kilometers: 1, 5, 0, and 1 KILOMETER. The scale is marked with a grid of 24 equal segments, with the first and last segments labeled '1' and '5' respectively. The 1000-foot mark is at the 1-kilometer mark, and the 7000-foot mark is at the 5-kilometer mark.

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
AND STATE OF LOUISIANA, DEPARTMENT OF PUBLIC WORKS, BATON ROUGE, LOUISIANA 70804
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

LOUISIANA

QUADRANGLE LOCATION

QUADRANGLE LOCATION

BS Backswamp

Historic Accretion Deposits

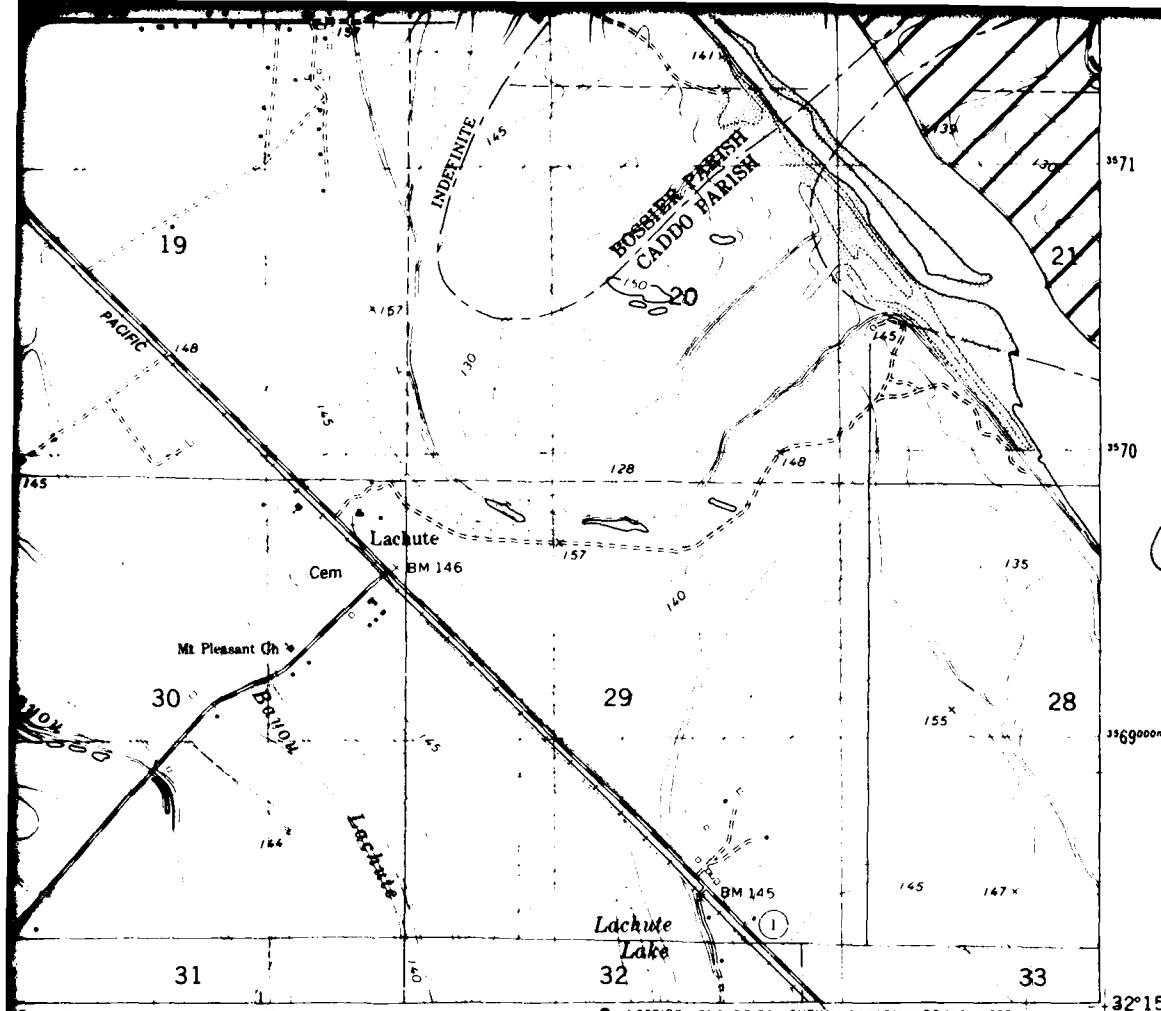
RS Rimswamp

QT_L Low Terrace



Valley Margin Lake

— Upland Scarp



• INTERIOR GEOLOGICAL SURVEY, RESTON, VIRGINIA—1980

WILLIAMS 4.4 MI.

NATCHITOCHES 47 MI.

ROAD CLASSIFICATION

Primary highway, hard surface	Light-duty road, hard or improved surface
Secondary highway, hard surface	Unimproved road
(I) Interstate Route	(U) S Route
(S) State Route	



QUADRANGLE LOCATION

ELM GROVE, LA.

SE/4 CASPIANA 15' QUADRANGLE

N3215-W9330/7.5

1980

DMA 7248 I SE-SERIES V885

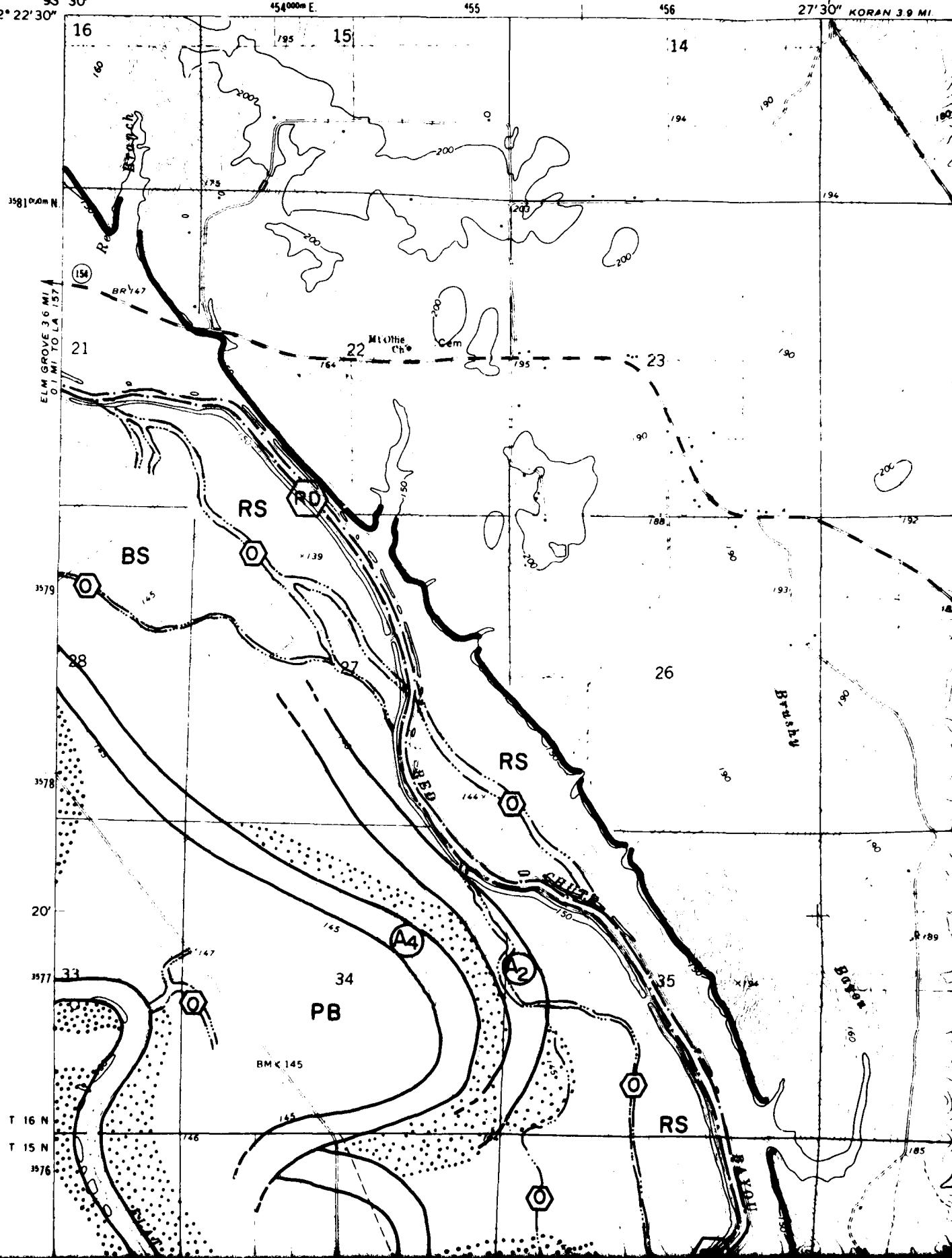
deposits

Plate 2. Geomorphic Map, Elm Grove Quadrangle

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

93° 30'
32° 22' 30"

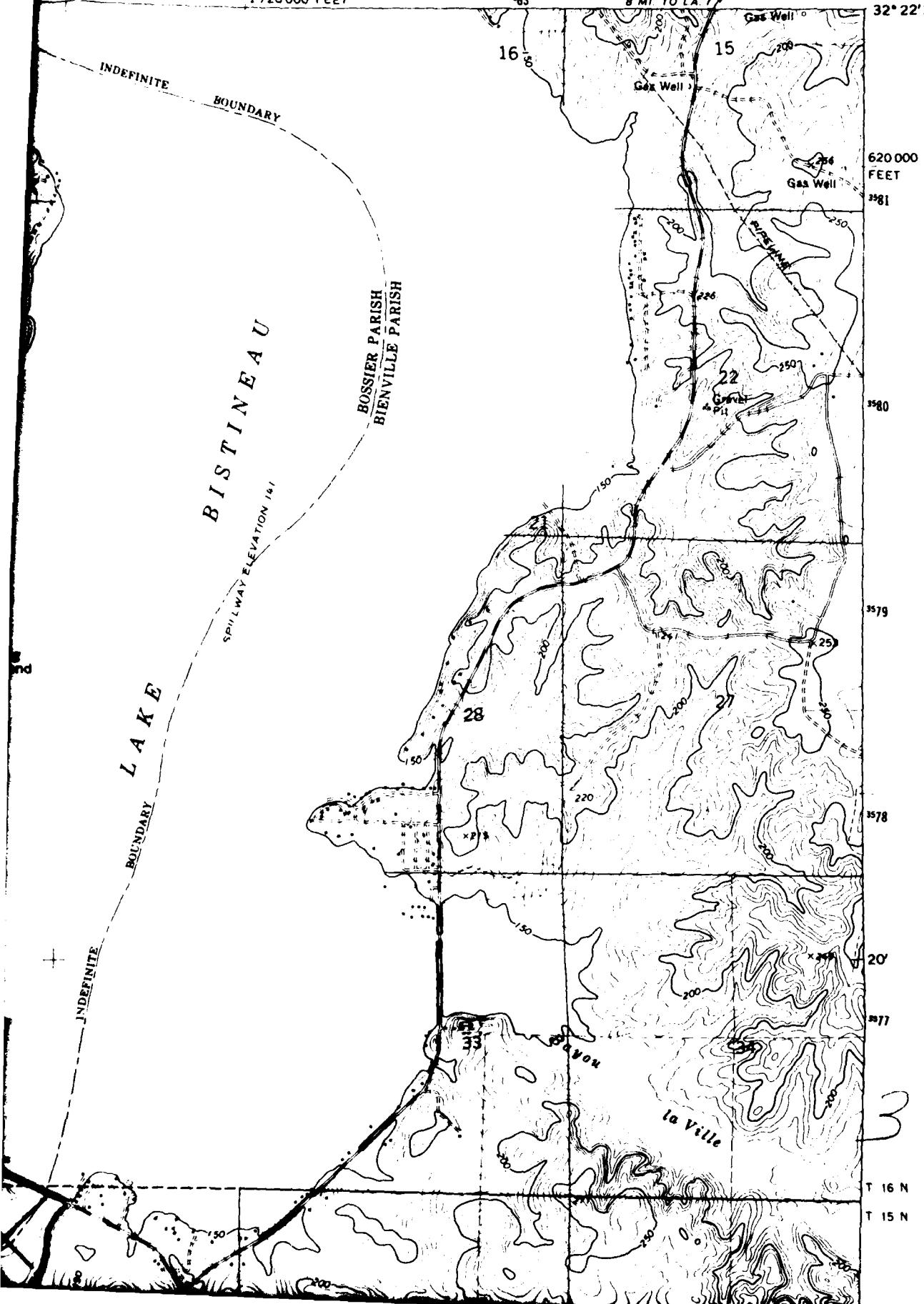
12481
CASPIANA 162 5001

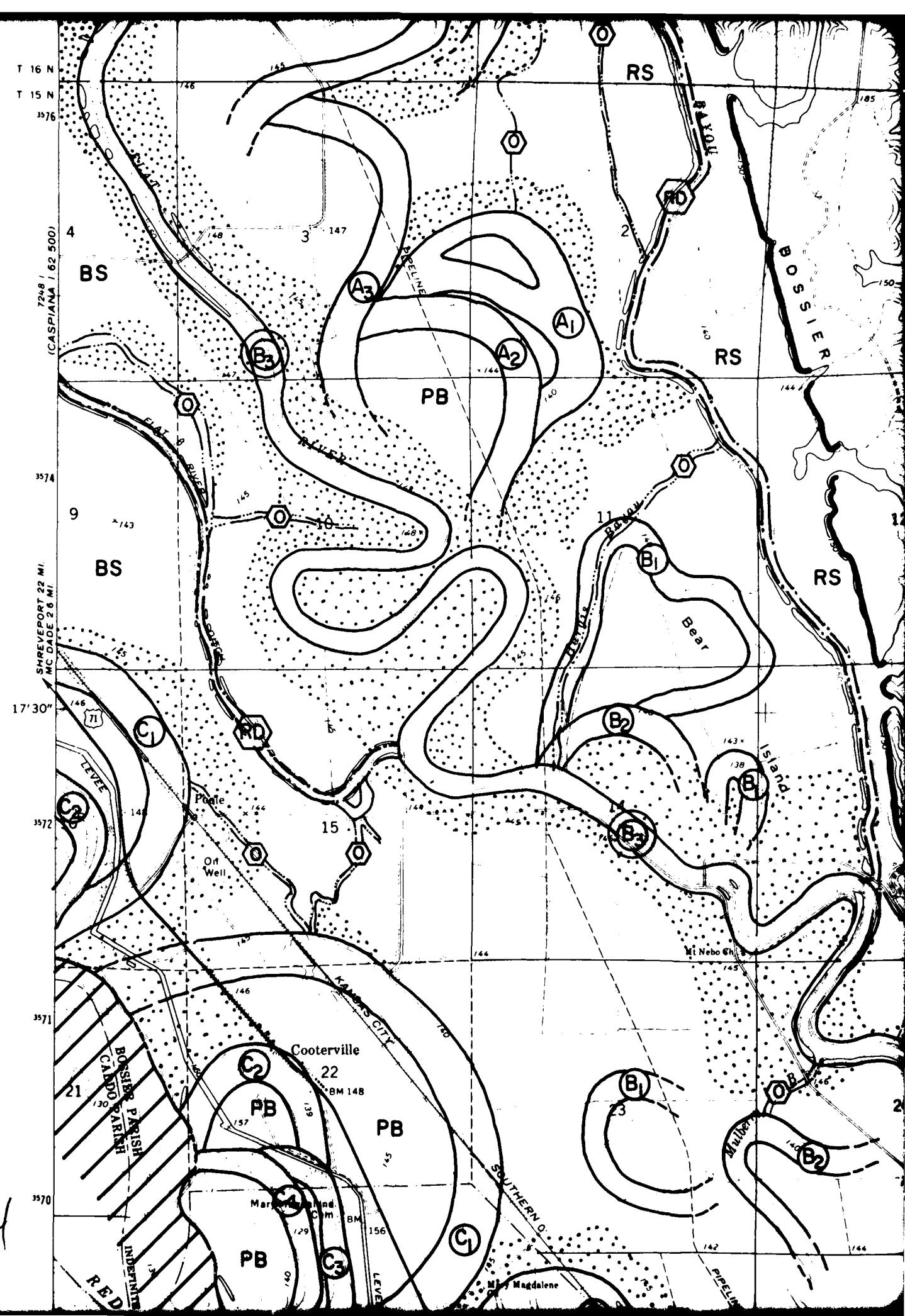


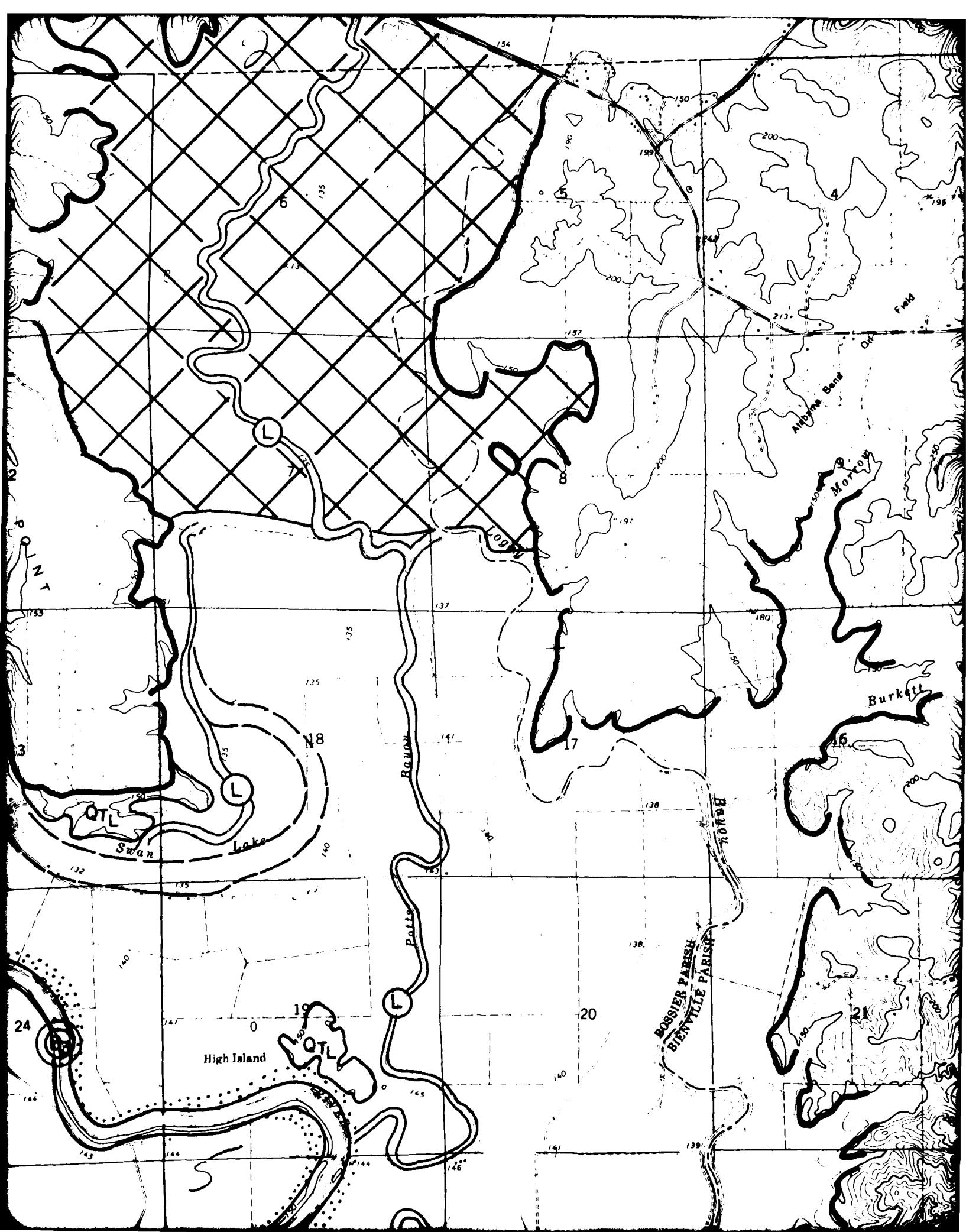
BOSSIER POINT QUADRANGLE
LOUISIANA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW/4 RINGGOLD 15' QUADRANGLE

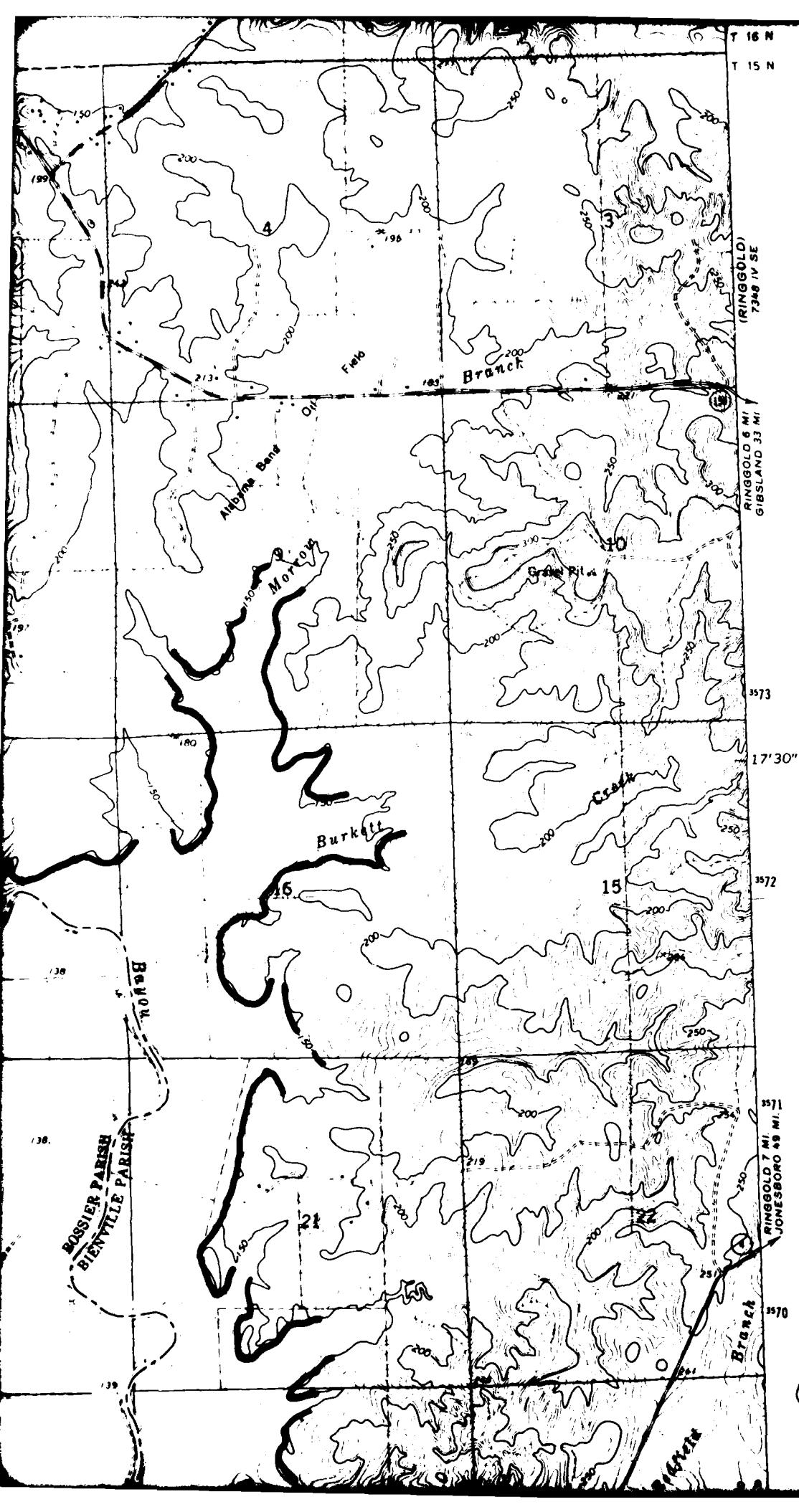
25' 461 1720000 FEET 463 8 MI. TO LA. 7 93° 22' 30" 301201204

7348 14 NE
(HEFLIN)

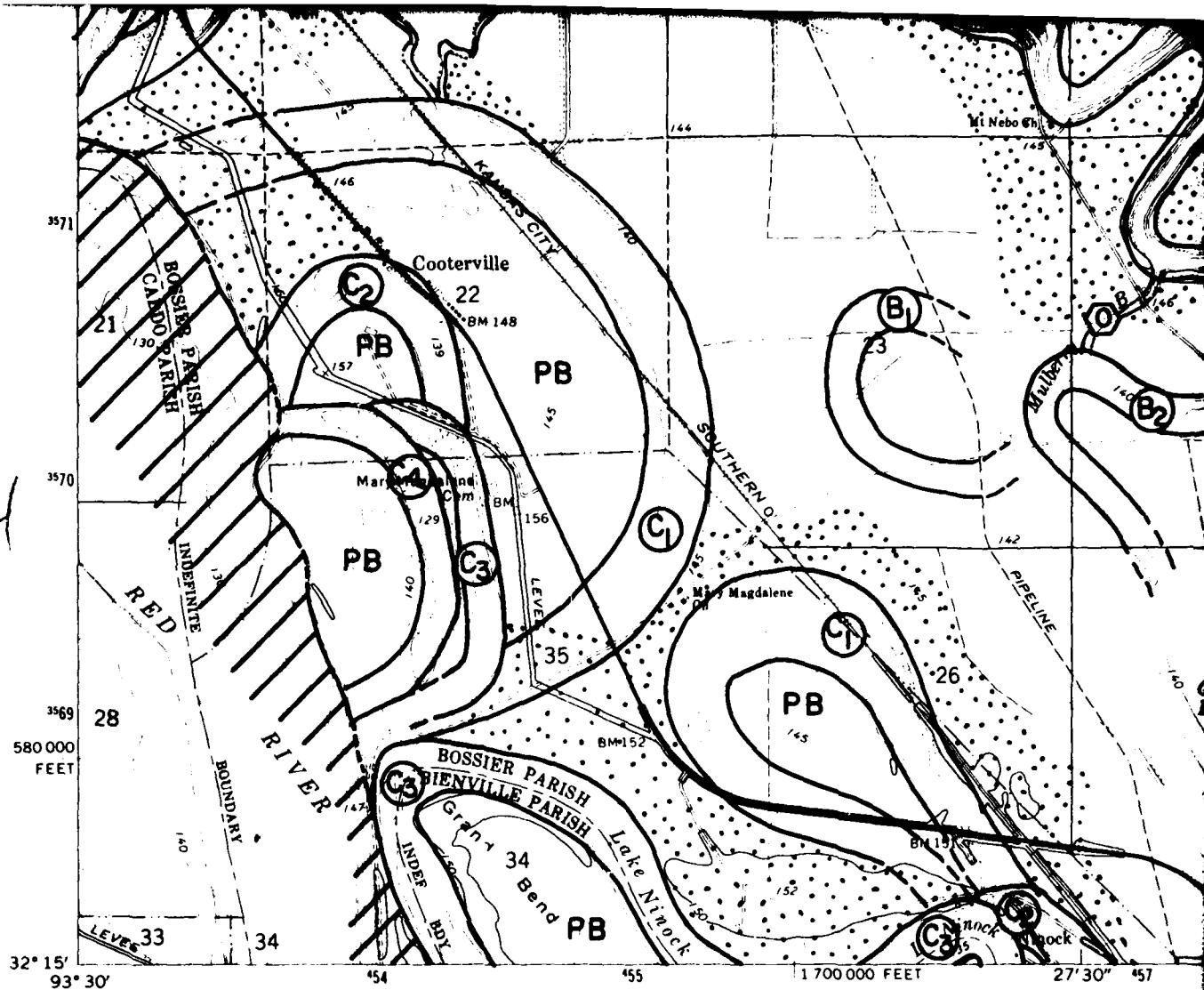








6



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1971. Field checked 1972

Projection and 10,000-foot grid ticks: Louisiana coordinate system, north zone (Lambert conformal conic)
1000-meter Universal Transverse Mercator grid ticks, zone 15, shown in blue. 1927 North American datum

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

GN
MN

6½°
0°14'
4 MILS

(A₁) Abandoned Channel

(O) Overflow Channel

(A) Abandoned Course

(NL) Natural Levee

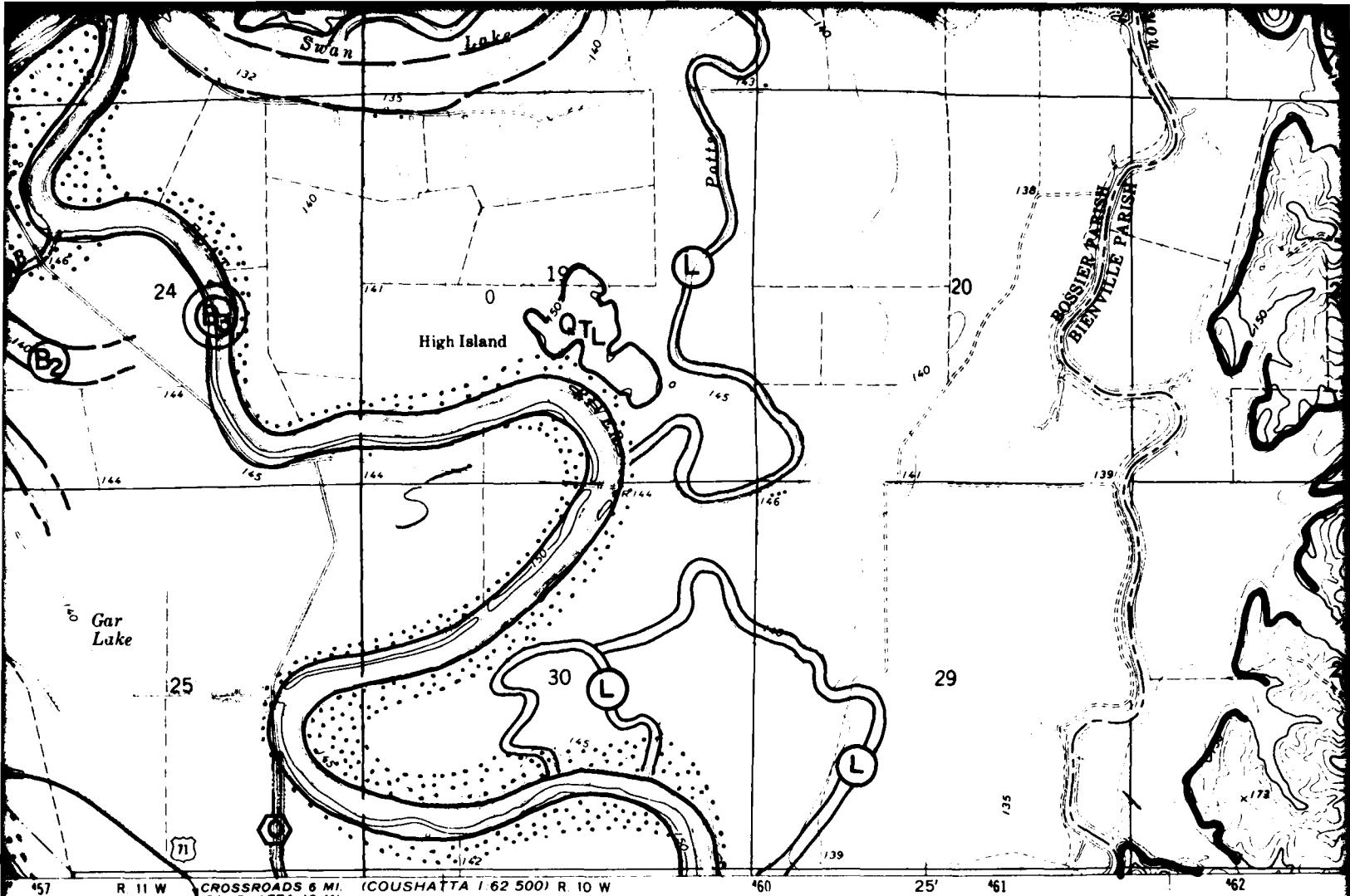
(L) Former Loggy Bayou

(C) Crevasse

(RD) Raft Distributary Channel

PB Point Bar

7



1 1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
 1 5 6 1 MILE
 1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
 1 5 6 1 KILOMETER

SCALE 1:24,000
 CONTOUR INTERVAL 10 FEET
 DOTTED LINES REPRESENT 5 FOOT CONTOURS
 DATUM IS MEAN SEA LEVEL



QUADRANGLE LOCATION

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
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 AND BY THE STATE OF LOUISIANA, DEPARTMENT OF PUBLIC WORKS, BATON ROUGE, LOUISIANA 70804
 A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

BS Backswamp

/// **Historic Accretion Deposits**

RS Rimswamp

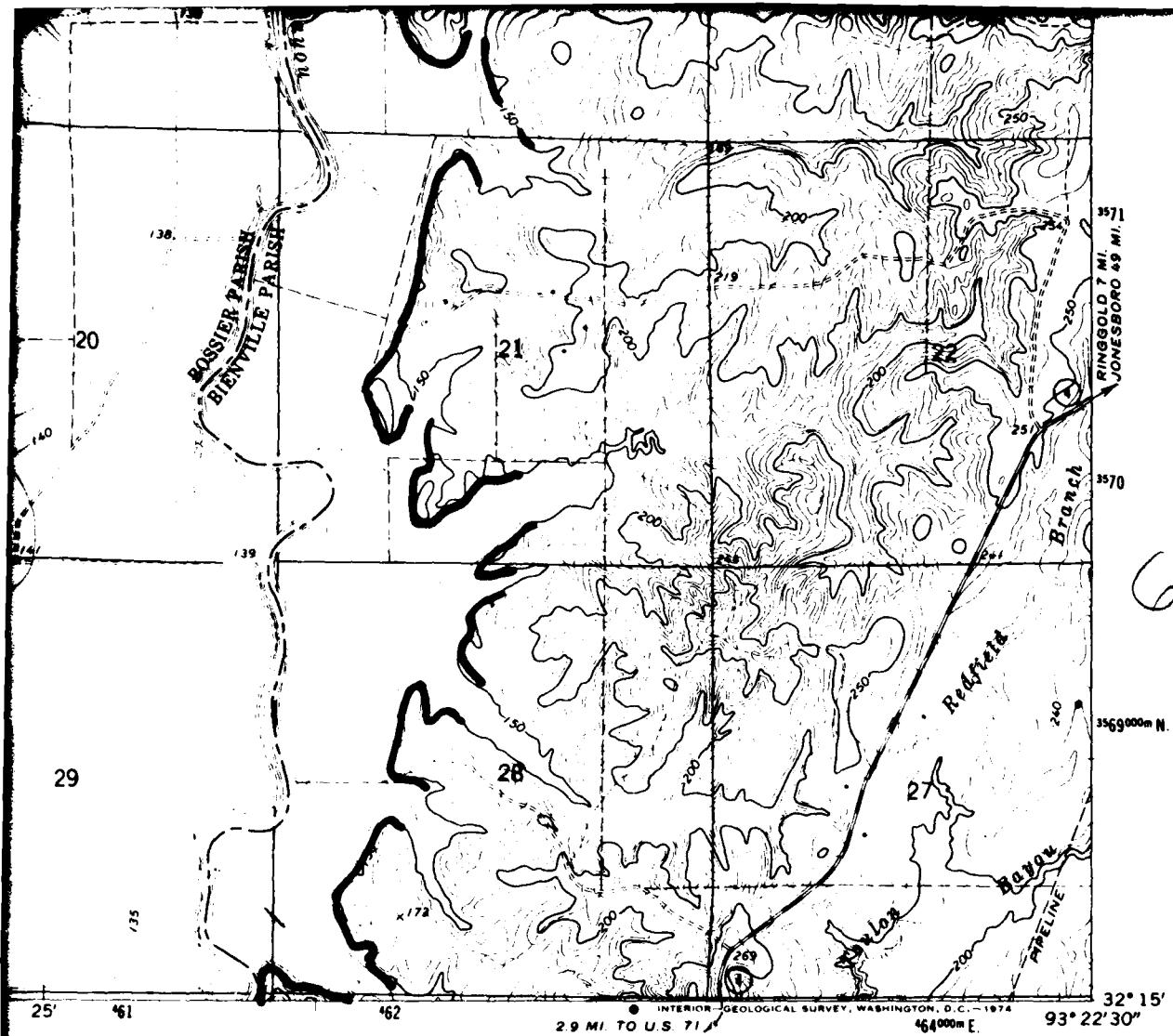
QTL Low Terrace

 **Valley Margin Lake**

— **Upland Scarp**

8

Plate 3. Geomor



ROAD CLASSIFICATION

Secondary highway.
hard surface - - - - - Unimproved

Interstate Route U S Route State Route



QUADRANGLE LOCATION

BOSSIER POINT, LA.

SW/4 RINGGOLD 15' QUADRANGLE
N3215—W9322.5/7.5

1972

AMS 7348 IV SW - SERIES V885

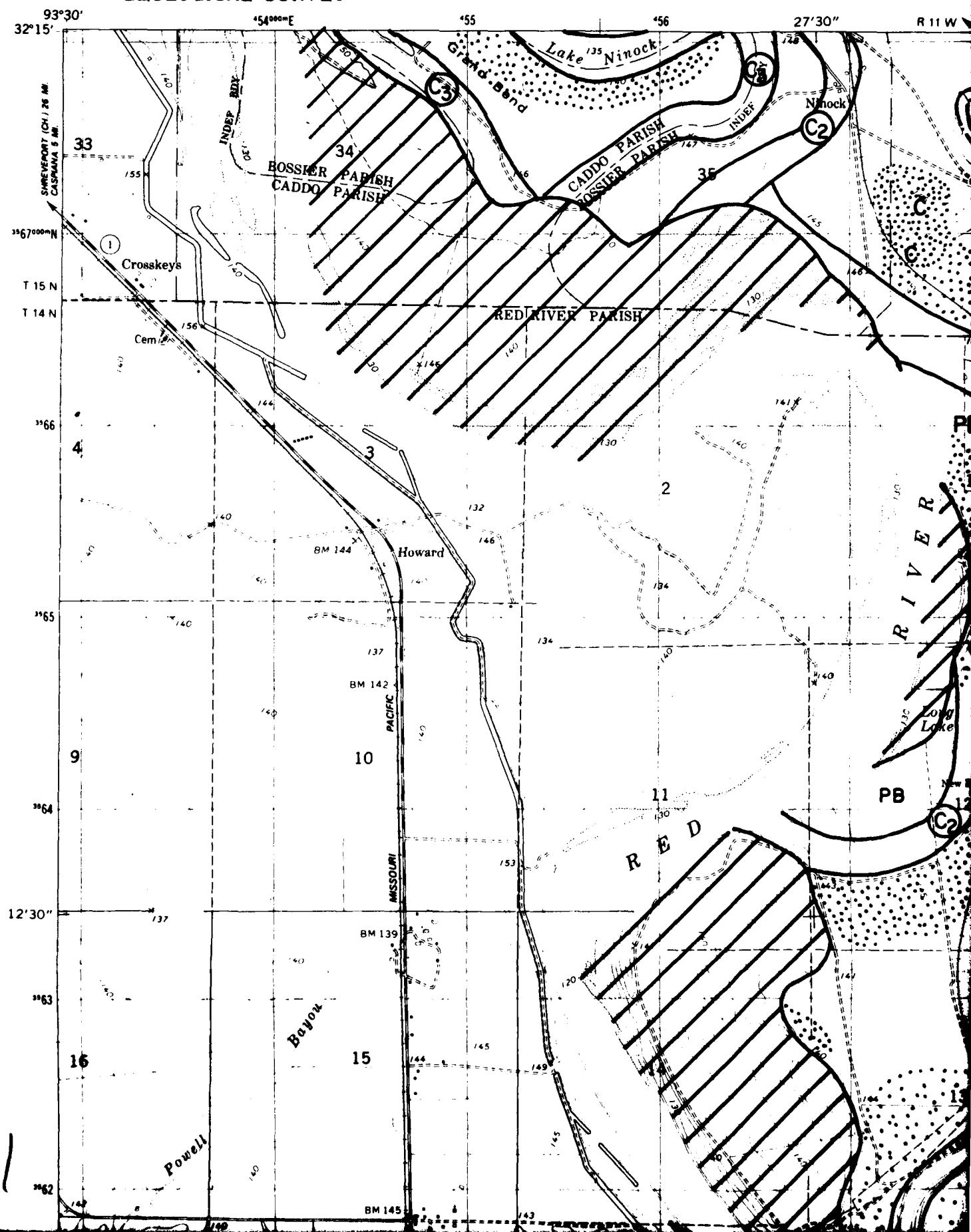
Deposits

9

Plate 3. Geomorphic Map, Bossier Point Quadrangle

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

THE 'SE
ELM GROVE



EAST POINT QUADRANGLE
LOUISIANA
7.5 MINUTE SERIES (TOPOGRAPHIC)

NW 1/4 COUSHATTA 15' QUADRANGLE

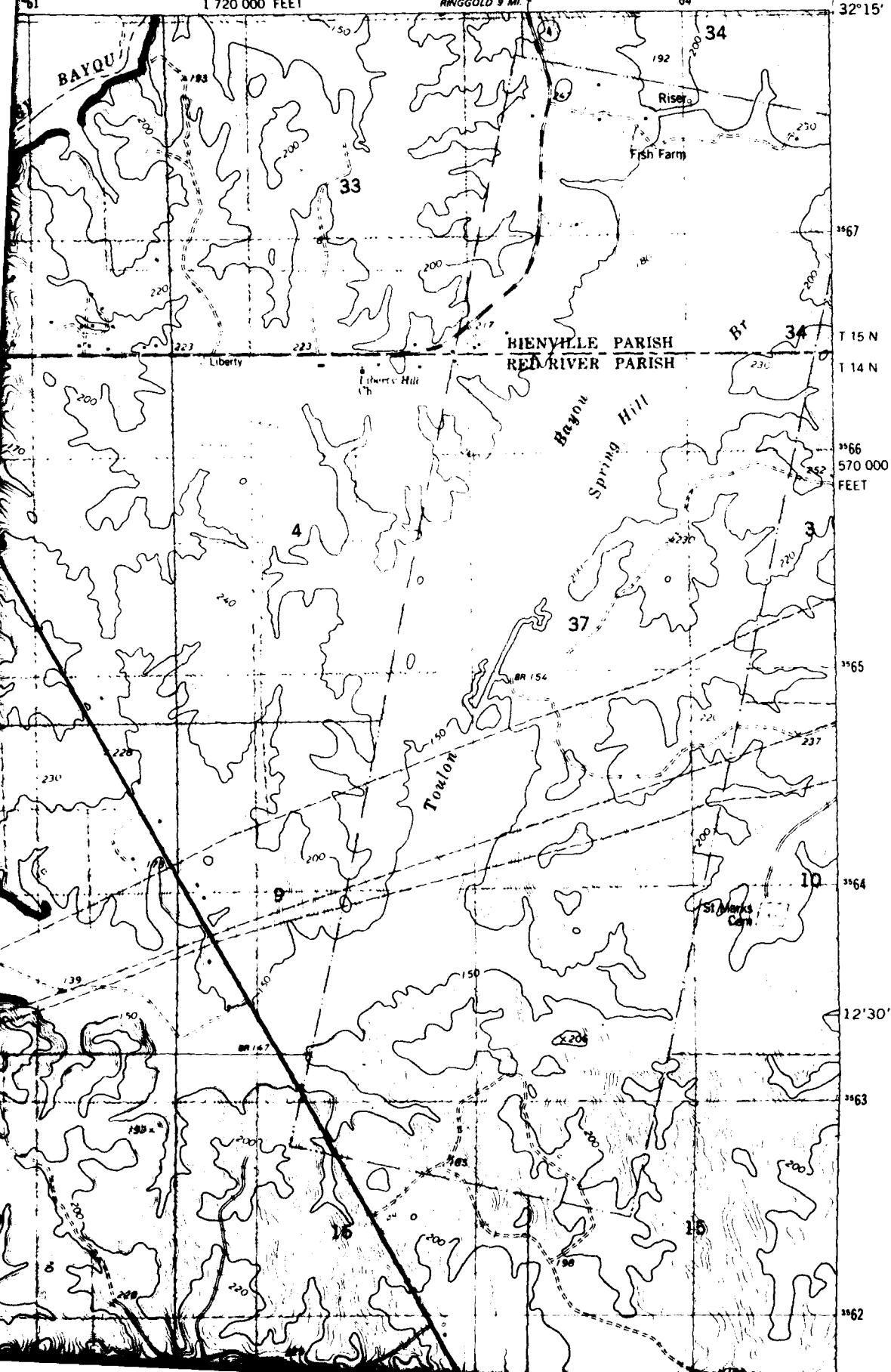
736 IV SE
RINGGOLD

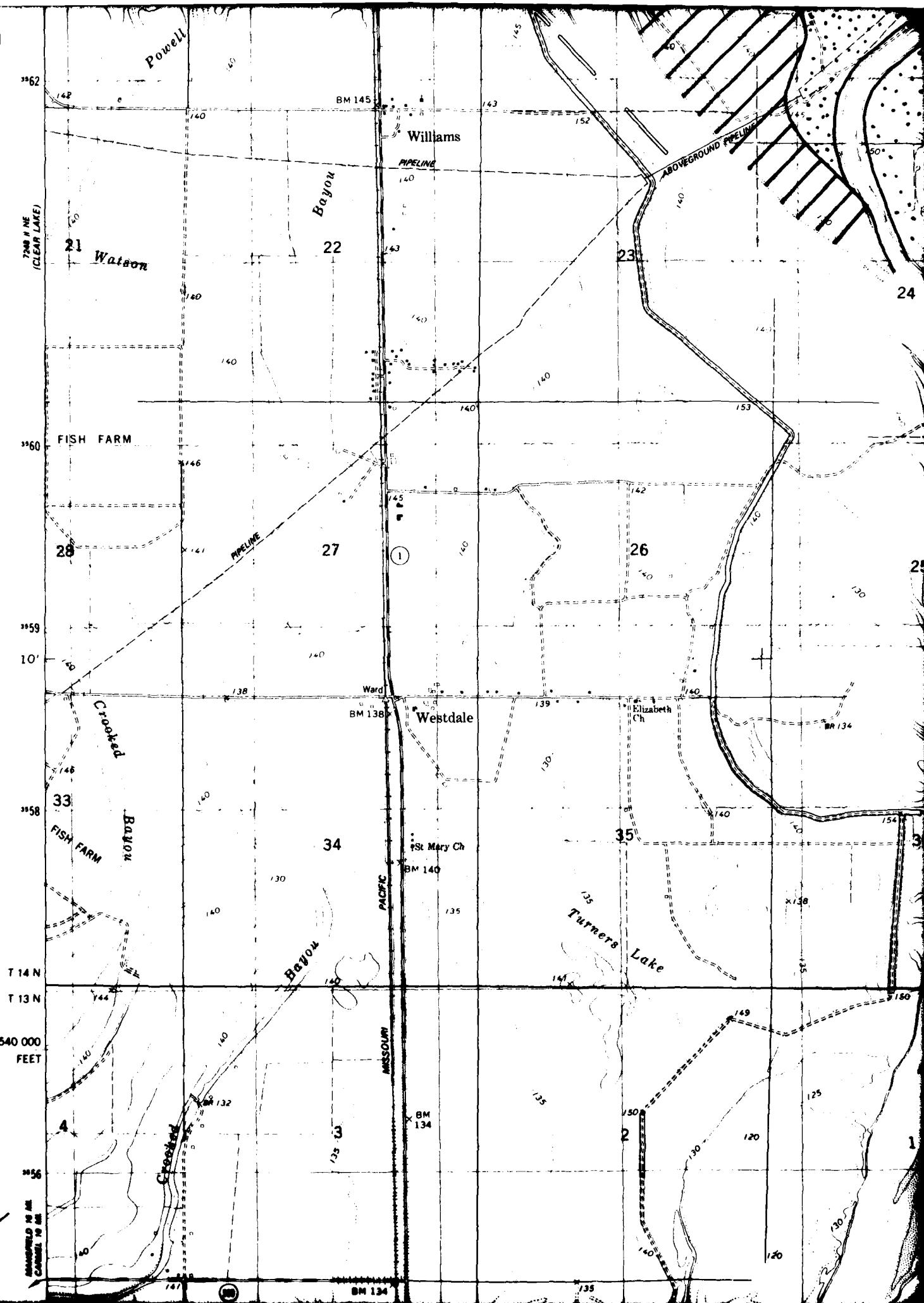
1720 000 FEET

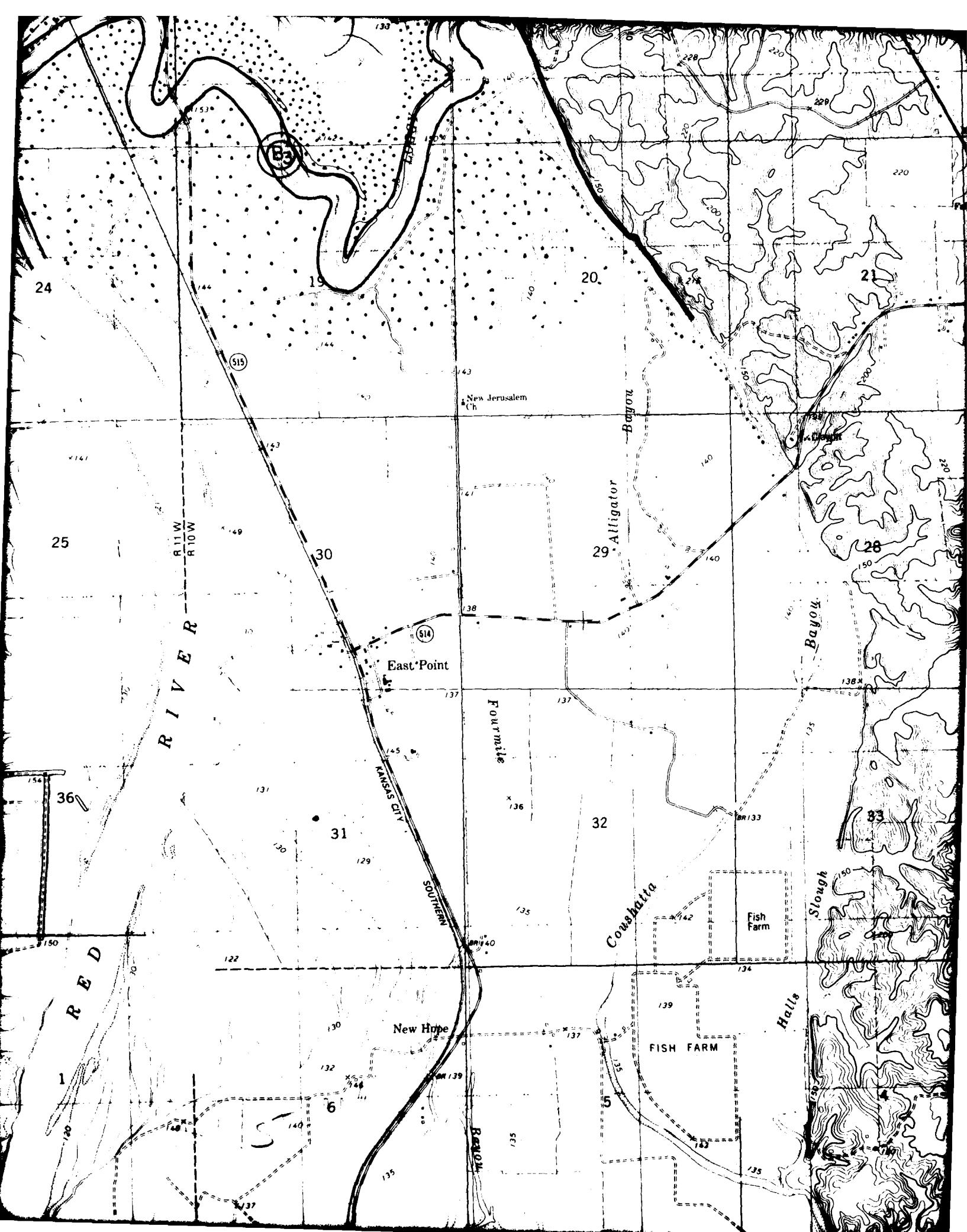
JONESBORO 50 MI.
RINGGOLD 9 MI.

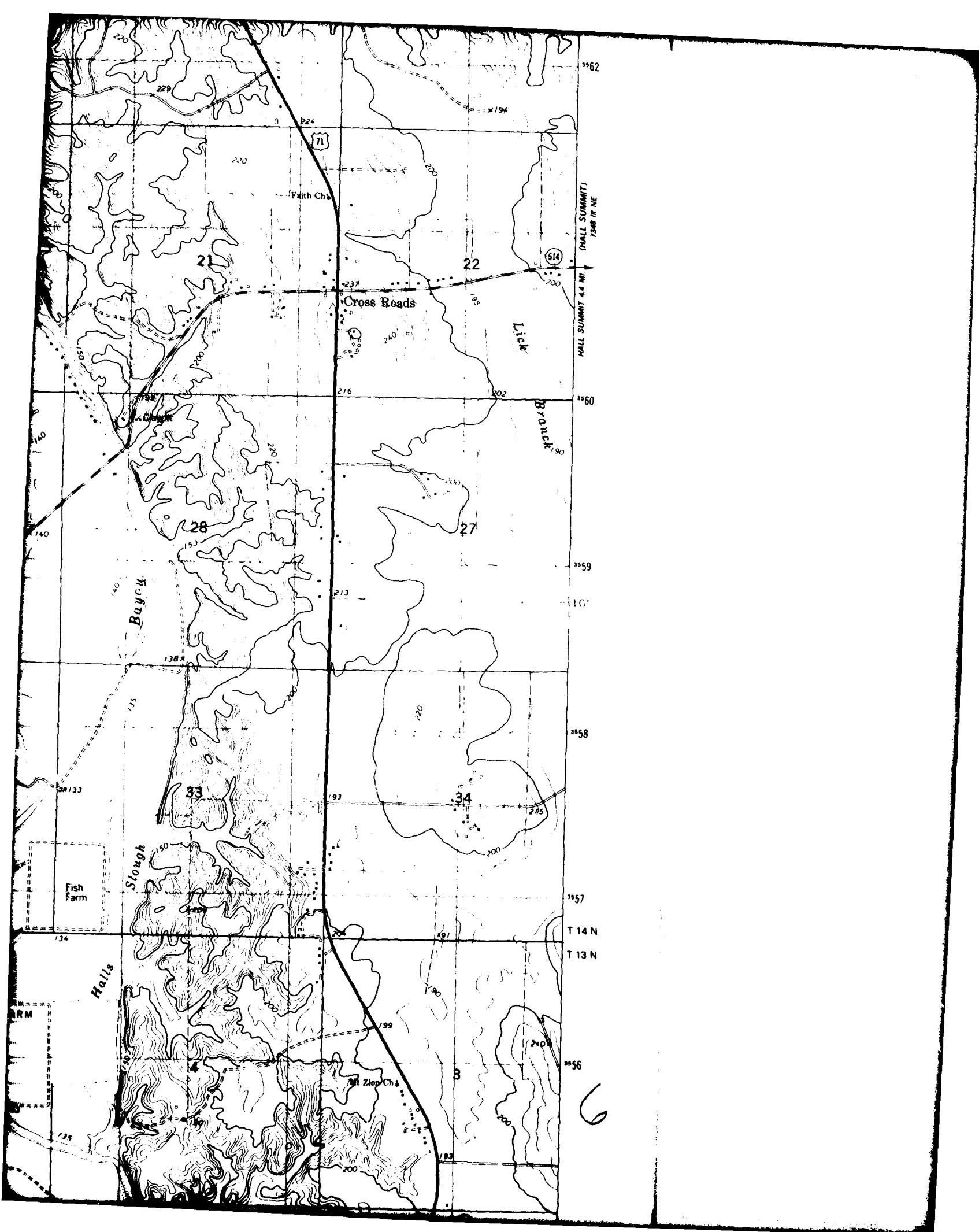
64

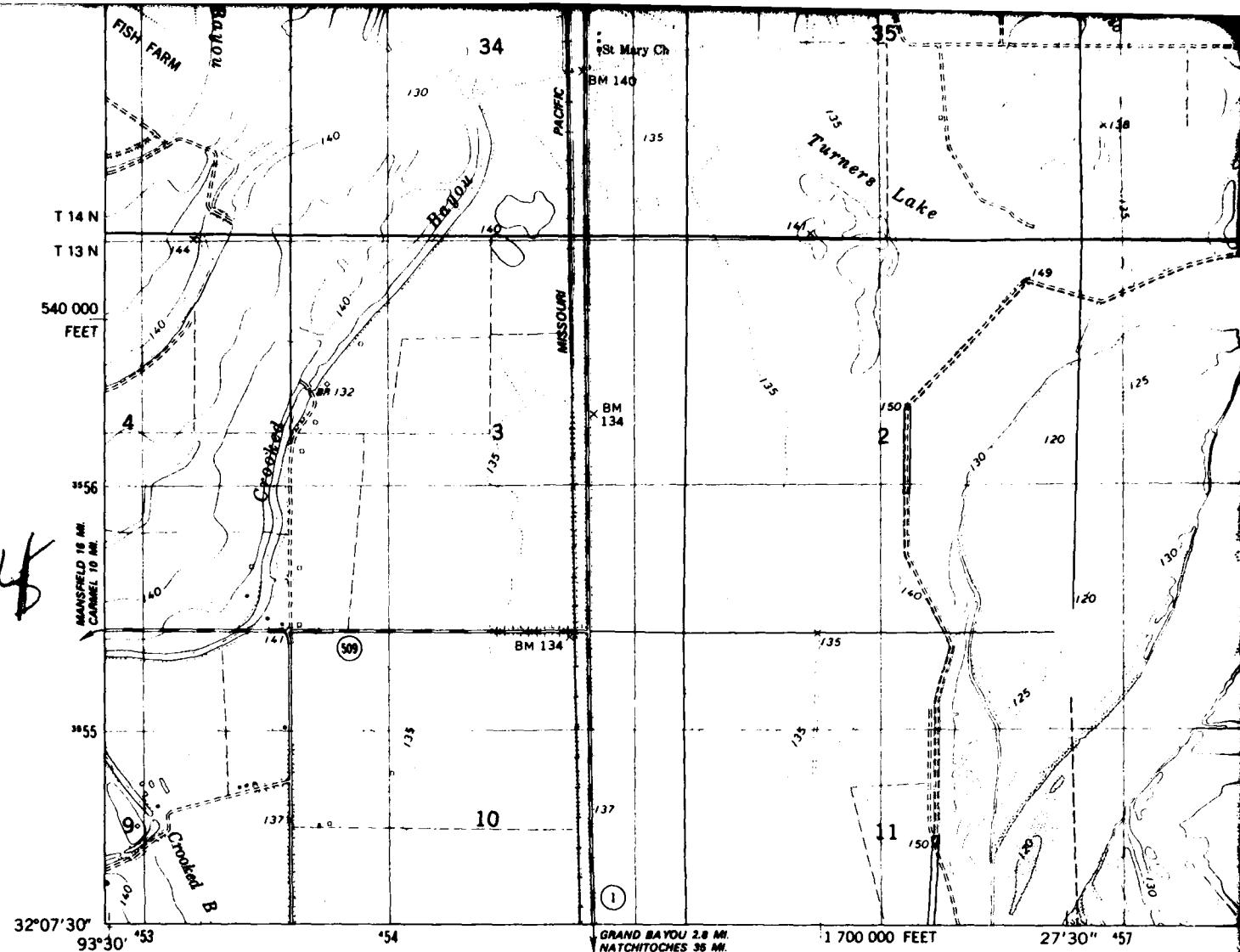
93°22'30"
32°15'











7

RD Raft Distributary Channel

PB Point Bar

BS

RS

C Crevasse

N Natural Levee

GN

MN

5W MILS

0°14' 98 MILS

111M GRID AND 111° MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

FOR SALE
AND STA

Abandoned Channel

Overflow Channel

Abandoned Course

Former Loggy Bayou

Point Bar

Crevasse

Natural Levee

GN

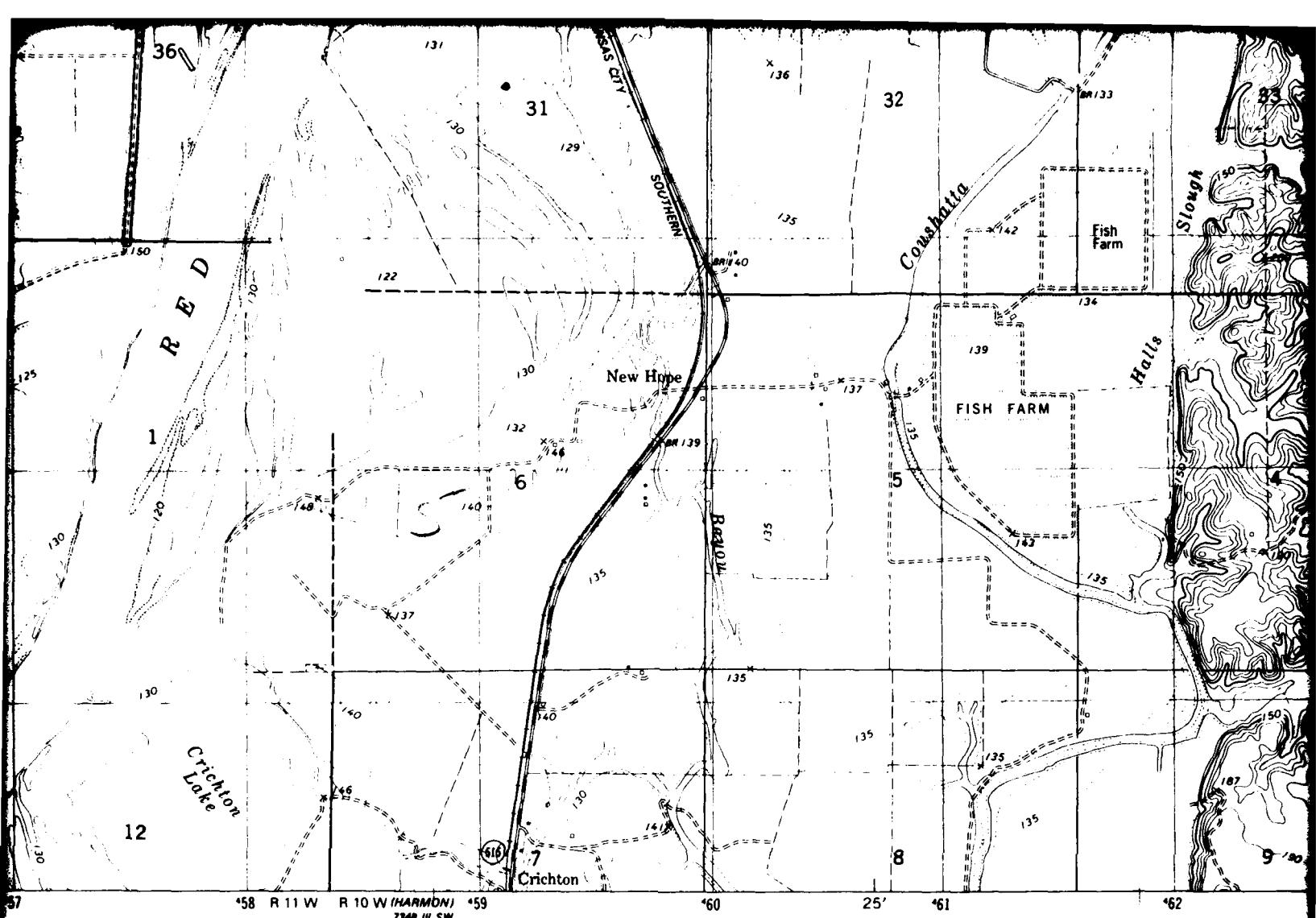
MN

5W MILS

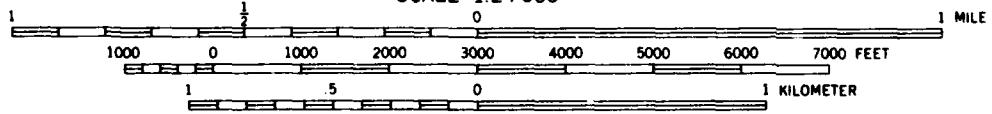
0°14' 98 MILS

111M GRID AND 111° MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

FOR SALE
AND STA



SCALE 1:24 000



CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
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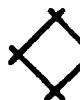
QUADRANGLE LOCATION

BS Backswamp

Historic Accretion Deposits

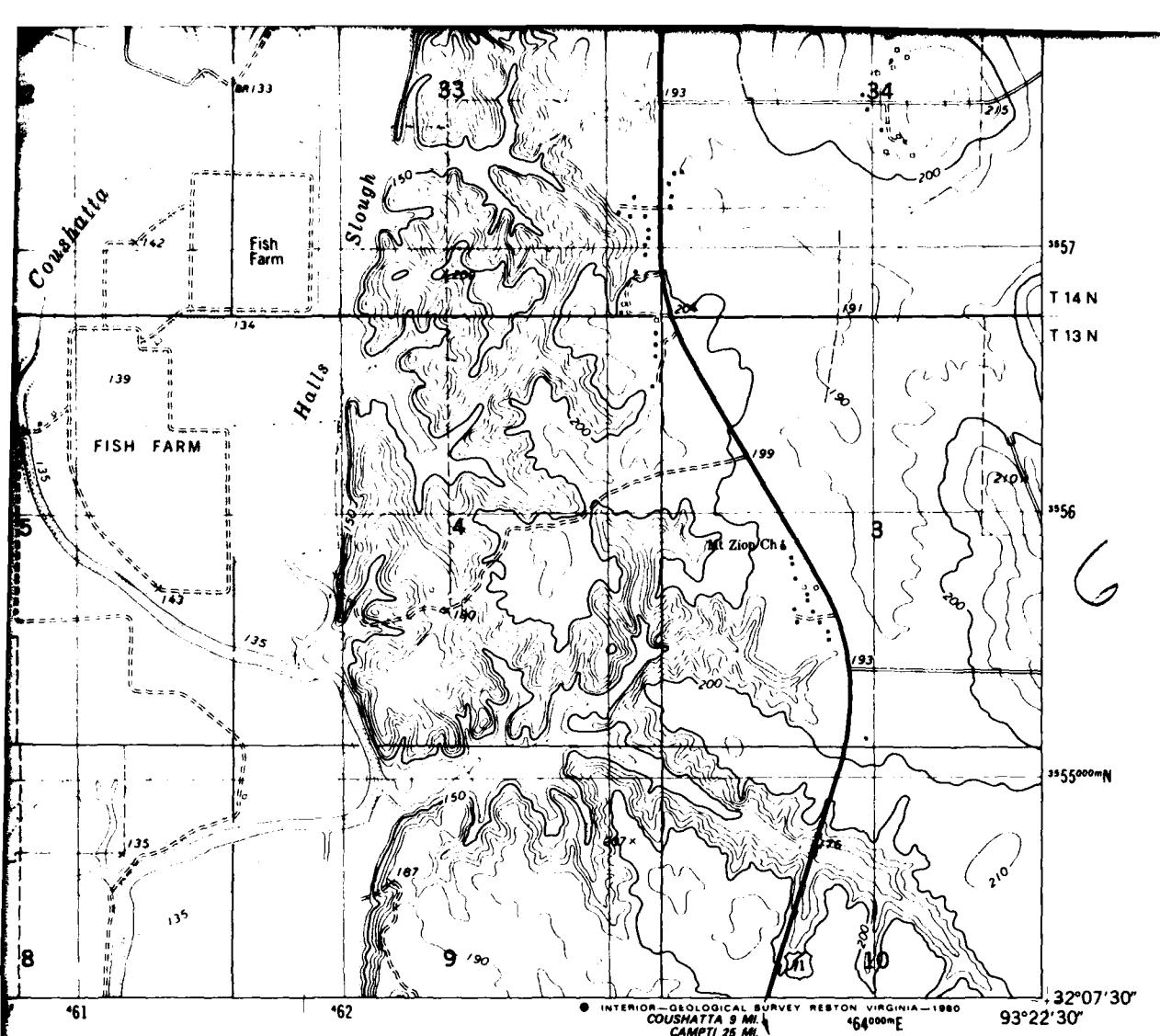
RS Rimswamp

QT_L Low Terrace

 **Valley Margin Lake**

Upland Scarp

Plate 4. Geom



• INTERIOR GEOLOGICAL SURVEY RESTON, VIRGINIA - 1980
 COUSHATTA 9 MI
 CAMPITI 25 MI
 640000E

32°07'30" 93°22'30"

ROAD CLASSIFICATION

Primary highway, hard surface — Light-duty road, hard or improved surface —

Secondary highway, hard surface — Unimproved road —

Interstate Route U. S. Route State Route

(COUSHATTA)
 Quad N SE



QUADRANGLE LOCATION

EAST POINT, LA.

NW/4 COUSHATTA 1:250,000 QUADRANGLE

N3207.5-W9322.5/7.5

1979

DMA 7348 III NW-SERIES V885

osits

9

Plate 4. Geomorphic Map, East Point Quadrangle

In accordance with letter from DAEN-RDC, DAEN-ASI dated 22 July 1977, Subject: Facsimile Catalog Cards for Laboratory Technical Publications, a facsimile catalog card in Library of Congress MARC format is reproduced below.

Smith, Lawson M.
Geomorphic investigation of the Bayou Bodcau and Tributaries Project Area, Louisiana / by Lawson M. Smith (Geotechnical Laboratory, U.S. Army Engineer Waterways Experiment Station). -- Vicksburg, Miss. : The Station ; Springfield, Va. ; available from NTIS, 1982.
32 p., 4 p. of plates : ill. ; 27 cm. -- (Miscellaneous paper ; GL-82-12)
Cover title.
"September 1982."
Final report.
"Prepared for U.S. Army Engineer District, Little Rock."
Bibliography: p. 31-32.
1. Archaeology. 2. Bayou Bodcau (La.) 3. Environmental impact analysis. 4. Geomorphology. I. United States. Army. Corps of Engineers. Little Rock District. II. U.S.

Smith, Lawson M.
Geomorphic investigation of the Bayou Bodcau : ... 1982.
(Card 2)

Army Engineer Waterways Experiment Station. Geotechnical Laboratory. III. Title IV. Series: Miscellaneous paper (U.S. Army Engineer Waterways Experiment Station) ; GL-82-12.
TA7.W34m no.GL-82-12